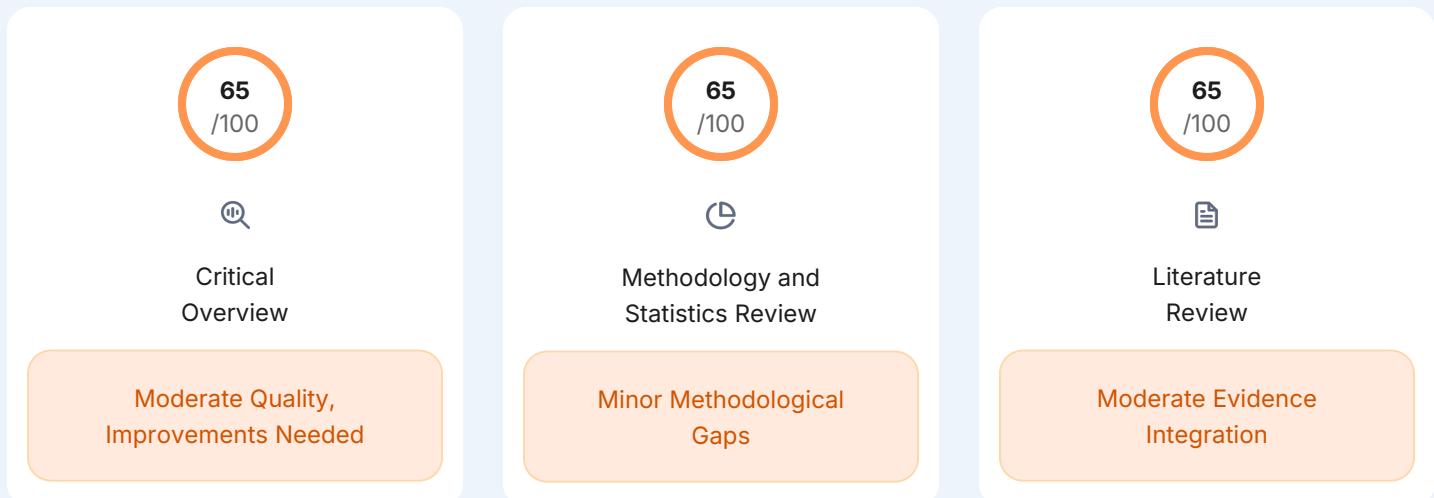


PeerPilot Research Review Report

PAPER TITLE

Optical fibers made of alkali-glasses with enhanced third-order nonlinearity for reversible second-harmonic generation

SCORES



PAPER TYPE

Original Article - Experimental

STUDY SUMMARY

This manuscript reports the design, fabrication and characterization of optical fibers made from custom alkali-rich soft glasses (ZR3 core, SK222 cladding) with third-order nonlinear susceptibility enhanced by factors of $\sim 1.9\text{--}4$ compared with fused silica. The authors estimate $\chi(3)$, nonlinear refractive index n_2 , and the resulting field-induced $\chi(2)$ for these glasses using measured refractive indices and Miller's rule, showing higher expected second-order susceptibility than silica at 516 nm. A side-hole fiber geometry is realized, with a small elliptical core and large side holes that can be filled with tungsten electrodes, and its linear properties (birefringence, dispersion, numerical aperture, mode profile) are modeled and experimentally validated. Short fiber sections (4–7 cm) are pumped with 206 fs pulses at 1031.8 nm while DC voltages up to 600 V are applied between tungsten wires at room temperature, creating an internal electrostatic field via alkali-ion migration and inducing second-harmonic generation (EFISH process). The generated green second harmonic at ~ 516 nm is observed under non-phase-matched conditions ($\Delta k \approx 0.012 \mu\text{m}^{-1}$), with output efficiency E_{out} up to 0.019% and conventional efficiency E up to $1.12 \times 10^{-6}\%$, both scaling quadratically with voltage and linearly with coupled power. Time-resolved measurements show rapid onset (≈ 3 s to reach $\sim 40\%$ of maximum SH intensity) and decay (mean lifetime ~ 13 s) of the SH signal upon voltage on/off, indicating reversible and switchable second-order nonlinearity in these alkali-glass fibers.

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Study Type: Original Article - Experimental

The manuscript reports laboratory fabrication and characterization of custom alkali-based glasses and side-hole optical fibers, followed by controlled electrical poling and femtosecond-laser experiments to measure second-harmonic generation efficiencies, temporal dynamics, and linear optical properties. These are original, quantitative bench experiments on materials and devices, not observational, theoretical, or purely modeling work.

Weaknesses

- 1 SHG efficiencies uncalibrated across wavelengths; detector responsivity not corrected.
- 2 Key measurements lack error bars, repeats, and formal uncertainty estimates.
- 3 Recent non-silica, alkali-glass SHG literature incompletely cited and compared.
- 4 Most authors missing institutional email addresses, limiting accountability.
- 5 Conflict of interest statement absent, reducing transparency of potential biases.

Strengths

- 1 Detailed glass compositions and nonlinear properties support reproducibility.
- 2 Strong numerical-experimental agreement on fiber linear characteristics.
- 3 Clearly described SHG setup with effective IR/VIS separation.
- 4 Systematic SHG characterization across voltage, power, and time.
- 5 Foundational models and material data appropriately and accurately cited.

Overall Recommendation

The manuscript presents a carefully designed experimental study demonstrating reversible EFISH-based second-harmonic generation in soft-glass side-hole fibers, supported by coherent numerical modeling and experimental characterization of the fiber's linear properties. Methodologically, the main limitations concern the calibration and uncertainty quantification of efficiency measurements, the lack of explicit error bars and repeatability information across key datasets, and incomplete descriptions of how certain derived parameters (Δk and temporal constants) were obtained. Addressing these issues through clearer detector calibration procedures, basic uncertainty analyses, and more detailed reporting of analysis methods would substantially strengthen confidence in the quantitative claims without requiring fundamental changes to the experimental setup. Overall, the work appears methodologically sound and likely publishable after minor-to-moderate revisions focused on measurement rigor and documentation.

Weaknesses

- 1 Spectral power-based efficiencies lack calibration and uncertainty analysis
- 2 Plots and parameters reported without explicit error bars or repeats
- 3 $\chi(2)$ estimates rely on optimistic breakdown-field assumptions
- 4 Methods for Δk and temporal constants are insufficiently described
- 5 Minor numerical inconsistencies and typographical issues in results

Strengths

- 1 Detailed description of tailored alkali-glass compositions and properties
- 2 Good agreement between numerical simulations and measured fiber parameters
- 3 Well-documented SHG experimental setup with clear efficiency definitions
- 4 Systematic exploration of SHG versus voltage, power, and time
- 5 Data availability on request supports reproducibility of key results

Detailed Observations

Section-wise analysis of strengths and weaknesses identified in the methodology.

Weakness

Severity: Minor | Confidence: High

Methods: Study design

$\chi(2)$ estimates assume breakdown fields without uncertainty analysis

The third- and second-order susceptibilities are estimated using refractive indices, Miller's rule, and dielectric breakdown fields from related glasses. The $\chi(2)$ values quoted for SK222 and ZR3 implicitly assume that the frozen-in dc field can reach the dielectric breakdown strength, which is an optimistic upper bound rather than a realistic operating field for the present fiber (applied voltages are only up to 600 V over \sim 100 μ m). No uncertainty analysis, sensitivity study, or experimental back-calculation of $\chi(2)$ from the measured SHG efficiency is provided. This may lead readers to overinterpret the quoted $\chi(2)$ as experimentally achievable rather than theoretical maxima. While the qualitative conclusion that these glasses can support larger $\chi(2)$ than silica is plausible, the quantitative values should be presented more cautiously.

Excerpt- "Considering dielectric breakdown strength and estimated $\chi(3)$ value, we can expect enhancement of the second-order susceptibility of in-house glasses with respect to silica. For SK222... $\chi(2)$ at 516 nm is slightly higher, reaching a value of 0.619 pm V $^{-1}$; however, for core ZR3 glass it is much higher, achieving 1.283 pm V $^{-1}$."

Recommendation:

Clarify that the $\chi(2)$ values derived using Ebd represent theoretical upper bounds, provide an estimate of the actual internal field under the applied voltages, and, if feasible, extract an experimental $\chi(2)$ from the SHG data for comparison, including an uncertainty estimate.

● Weakness

Severity: Major | Confidence: High

Methods: Study design

Spectral power-based efficiencies lack calibration and uncertainty analysis

The main quantitative outcome—the SHG efficiency—is derived by numerically integrating IR and VIS spectra from an optical spectrum analyzer/spectrometer. However, detectors typically have a strongly wavelength-dependent responsivity, particularly when comparing ~ 1032 nm and ~ 516 nm. The manuscript does not describe any radiometric calibration of the spectral response or correction factors applied across this spectral range. While P_ω is said to agree with a power-meter reading, there is no independent check of $P_{2\omega}$, and the ratio $P_{2\omega}/P_\omega$ (E_{out}) may be significantly biased by detector sensitivity differences. No uncertainty bounds are provided for the reported 0.019% efficiency. This undermines quantitative confidence in the absolute value of efficiency, even though the qualitative trends versus voltage and power are likely robust.

Excerpt- "At the output, we recorded the IR and VIS spectra using an optical spectrum analyzer. Both spectra were integrated, i.e. we calculated the mathematical area under the curve with subtracted noise level, resulting in average power values P_ω and $P_{2\omega}$..."

Recommendation:

Describe the calibration of the spectrometer/OSA response at both fundamental and SH wavelengths, or measure $P_{2\omega}$ with a calibrated power meter or photodiode. Provide an uncertainty estimate on E and E_{out} that includes detector responsivity, integration procedure, and alignment variability.

● Weakness

Severity: Major | Confidence: High

Methods: Study design

Key measurements lack explicit error bars and repeatability data

Efficiency–voltage plots (figures 9 and 10), temporal transients (figure 11), and linear-property measurements are presented without visible error bars or explicit numbers of repeats and standard deviations (beyond a single ± 2 s estimate). It is unclear how many independent fiber pieces or experimental runs under identical conditions were performed, and how much variation was observed between them. Without a clearer treatment of measurement uncertainties and repeatability, the reliability of precise quantities such as 0.019% maximum efficiency, 3 s rise time, and 13 s decay time is difficult to assess. This mainly affects quantitative confidence rather than the qualitative demonstration of reversible SHG.

Excerpt- "The SHG is immediate, since about 3 s is enough to reach about 40% of the highest intensity at a voltage of 600 V... The average mean lifetime obtained from several experiments is 13 ± 2 s."

Recommendation:

Report the number of independent samples and repeated measurements for key datasets, include error bars or scatter in the plots, and provide brief uncertainty budgets for quantities such as efficiency, birefringence, dispersion, and temporal constants.

● Weakness

Severity: Minor | Confidence: High

Methods: Study design

Coupling efficiency estimated, not measured, affecting E definition

The coupled power P_c is inferred from a theoretical estimate of coupling efficiency (~9%) based on spot size, NA mismatch, and Fresnel losses, rather than a direct measurement of power launched into and emerging from the fiber core (e.g. via a cut-back or reference fiber). As a result, the 'traditional' efficiency $E = P_2\omega/P_c$ may carry a substantial systematic uncertainty. While $E_{out} = P_2\omega/P\omega$ partially circumvents this by using measured output IR power, the uncertainty in P_c limits the interpretability and comparability of E with other works.

Excerpt- "Including these factors and the fact that the spot size could be slightly larger than the core due to misalignment, we estimate the lowest value of the coupling efficiency at a level of 9% [26]."

Recommendation:

Where possible, perform a direct measurement of coupling efficiency (e.g. by comparing throughputs of a reference straight fiber or via cut-back) and update P_c and E accordingly, or provide a sensitivity analysis showing how E varies over a plausible coupling-efficiency range.

● Weakness

Severity: Minor | Confidence: Medium

Methods: Study design

Limited control experiments probing robustness of EFISH mechanism

The observed quadratic dependence of SH power on voltage and linear dependence on coupled power are consistent with EFISH-induced $\chi(2)$. However, the manuscript presents limited information on control experiments that could further confirm the mechanism: e.g. behavior for polarization along the slow axis, reversed electrode polarity, or elevated temperatures to modulate ion mobility. Such controls would help to separate EFISH from other possible contributions (e.g. surface or defect-related nonlinearities) and to assess anisotropy of the induced $\chi(2)$. The lack of these additional tests does not invalidate the main finding, but constrains the depth of mechanistic insight.

Excerpt- "In most experiments, the input beam was linearly polarized along the fast axis of the fiber."

Recommendation:

Briefly report or discuss results for alternative polarizations and electrode polarities, and, if feasible, for different temperatures, to more comprehensively characterize the EFISH mechanism and anisotropy of the induced $\chi(2)$.

● Weakness

Severity: Minor | Confidence: High

Methods: Study design

Methods for Δk and temporal constants are not fully specified

The paper quotes a phase mismatch value ($\Delta k \approx 0.012 \mu\text{m}^{-1}$) and characteristic times for rise and decay of SH intensity, but does not detail how these were obtained. It is unclear whether Δk was derived purely from simulations, from measured dispersion, or from a combination of both, and whether it refers to effective-index or group-velocity mismatch. Similarly, the procedure used to extract the 3 s and 13 s characteristic times (e.g. exponential fits, threshold crossing, averaging over cycles) is not described. Without these methodological details, readers cannot easily reproduce or re-derive these derived quantities, and it is difficult to judge their precision.

Excerpt- "It is worth noting that the process is non-phase-matched with phase mismatch $\Delta k \approx 0.012 \mu\text{m}^{-1}$."

Recommendation:

Explain the calculation of Δk (including the dispersion data and formulas used) and the fitting or analysis procedure used to obtain the rise and decay times, and provide associated uncertainties or residuals where feasible.

● Weakness

Severity: Minor | Confidence: High

Methods: Study design

No convergence or sensitivity analysis for numerical mode solver

The numerical analysis is based on a specific mesh density and boundary condition choice in an FDE solver, but no convergence or sensitivity analysis is reported (e.g. comparing results for different mesh sizes or core/side-hole approximations). Although experimental comparisons suggest reasonable accuracy overall, the absence of an explicit convergence check leaves some residual uncertainty in simulated parameters such as effective indices, birefringence and Δk , particularly because the model simplifies the real geometry to ellipses. This is a modest limitation for those wishing to reuse the design numerically.

Excerpt- "For the FDE solver, we used a mesh structure having 90 000 rectangular elements with a cell size of $0.00025 \mu\text{m}$, to ensure high accuracy in the calculation of the propagation constants, and perfectly matched layer boundary conditions to minimize reflections."

Recommendation:

Include a brief statement on numerical convergence, such as the change in effective index or birefringence when the mesh is refined or when geometric approximations are varied, to document the numerical accuracy of the model.

● Weakness

Severity: Minor | Confidence: High

Methods: Study design

Apparent typographical error in reported efficiency magnitude

The abstract reports an efficiency term written as " $1.12 \times 10^{-60\%}$ ", which is physically implausible and almost certainly a typographical or formatting error (likely intending something like 10^{-6}). Such inconsistencies between notation and realistic magnitudes can confuse readers and raise questions about numerical accuracy. While this appears to be a presentation issue rather than a methodological flaw, it detracts from clarity and could hinder comparison with the more detailed efficiency values in the main text.

Excerpt- "...with a highest output efficiency E_{out} of 0.019% ($E = 1.12 \times 10^{-60\%}$) was observed."

Recommendation:

Carefully proofread all reported efficiencies and correct the apparent exponent/formatting error in the abstract, ensuring consistency with the values and notation used in the main text.

● Strength

Confidence: High

Methods: Study design

Clear description of tailored glass compositions and nonlinear properties

The manuscript provides detailed mass-percent compositions for both ZR3 and SK222 glasses, along with their refractive indices across relevant wavelengths. This level of detail allows other groups to reproduce the glass formulations and understand the material design rationale for enhancing $\chi(3)$ and, by extension, EFISH-induced $\chi(2)$. It also supports plausibility of the claimed high alkali content and its role in ionic migration. Such transparent reporting strengthens the methodological rigor of the materials design component.

Excerpt- "Two different samples of soft glasses based on a silicate matrix were designed and synthesized in-house to achieve a relatively high concentration of alkali metal ions and allow for optical fiber drawing [14]."

● Strength

Confidence: High

Methods: Study design

Consistent numerical-experimental validation of fiber linear properties

The authors not only simulate modal indices and dispersion using a finite-difference eigenmode solver but also experimentally measure group birefringence, chromatic dispersion, NA and mode-field diameters. They report close agreement between measurements and simulations, including a quantified shift in zero-dispersion wavelength. This cross-validation between modeling and experiment increases confidence that the linear optical properties used to infer phase mismatch and guiding behavior are accurate and not artifacts of an unvalidated numerical model.

Excerpt- "Birefringence, dispersion and numerical aperture (NA) of the SHF were also experimentally verified and compared with numerical results as shown in figures 4–6."

● Strength

Confidence: High

Methods: Study design

Well-documented SHG setup enabling clean IR/VIS separation

The SHG experimental configuration is described with useful detail: laser parameters, focusing optics, fiber length, electrode configuration, and detection scheme. Spatial separation of the IR and VIS beams using a prism, followed by dedicated collection optics and spectrometers, is an appropriate method to prevent detector saturation and to isolate the weak SH signal. This careful optical layout reduces cross-contamination between fundamental and harmonic channels and supports the validity of the observed green output as genuine SHG rather than spectral artifacts.

Excerpt- "The BK7 prism allowed for spatial separation of highintensity IR signal from low-intensity VIS signal and quantitative measurements of the power of the original IR spectrum and voltage-driven second-order VIS signal."

● Strength

Confidence: High

Methods: Study design

Systematic study of SHG versus voltage, power, and time

The dependence of SHG on both driving voltage and coupled power is studied systematically, revealing the expected quadratic dependence on electric field and linear dependence on input power in terms of efficiency. Temporal dynamics are also characterized, including rise, saturation, and decay when the voltage is switched on and off. Although the analysis could be more quantitative, the breadth of parameter space considered (U, P_c , and time) provides a coherent phenomenological picture consistent with EFISH-driven $\chi(2)$ induction.

Excerpt- "The efficiencies are presented in figure 9 as a function of bias voltage and coupled power. For constant bias voltage, efficiencies grow linearly with coupled power... for constant coupled power, efficiencies show quadratic growth with bias voltage..."

Overall Recommendation

From a literature perspective, the manuscript is generally well grounded, with most references relevant, technically appropriate, and free from retracted or unsupported sources. To strengthen it further, the authors should prune mild citation padding in clustered references, correct the mismatch between text and reference [23], and broaden coverage to include recent, closely related work on alkali- and non-silica glass fibers for $\chi(2)$ and SHG. Explicitly situating their results relative to these studies will sharpen the novelty claims and improve the balance and transparency of the literature review.



Weaknesses

- 1 Citation cluster [8–12]/[9–12] includes tangential waveguide SHG papers
- 2 Optical properties database citation [23] appears topically mismatched
- 3 Some key recent soft-glass and alkali-glass SHG studies are omitted
- 4 Minor citation cartel pattern around Couderc-related SHG fiber work



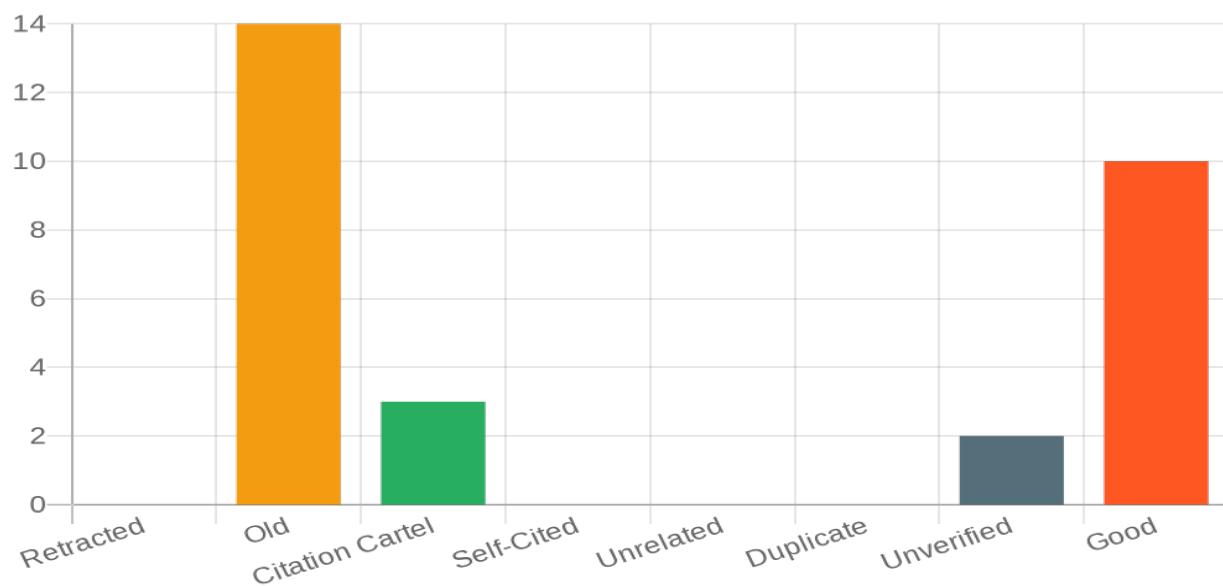
Strengths

- 1 References largely relevant and free of retracted or unsupported work
- 2 Introduction cites recent high-impact studies on SHG in fibers
- 3 Standard models and material data are well and clearly referenced

Overview

Total references: 26

Reference Drilldown



List of old references:

The following old references were detected. Newer sources should be cited wherever possible.

- 1 Eckardt R C, Masuda H, Fan Y X and Byer R L 1990 Absolute and relative nonlinear optical coefficients of KDP, KD * P, BaB₂O₄, LiIO₃, MgO:LiNbO₃, and KTP measured by phase-matched second-harmonic generation IEEE J. Quantum Electron. 26 922-33
- 2 Österberg U and Margulis W 1987 Experimental studies on efficient frequency doubling in glass optical fibers Opt. Lett. 12 57-59
- 3 An H and Fleming S 2007 Creating second-order nonlinearity in pure synthetic silica optical fibers by thermal poling Opt. Lett. 32 832-4
- 4 Margulis W, Tarasenko O and Myrén N 2009 Who needs a cathode? Creating a second-order nonlinearity by charging glass fiber with two anodes Opt. Express 17 15534-40
- 5 Canagasabey A et al 2009 High-average-power second-harmonic generation from periodically poled silica fibers Opt. Lett. 34 2483-5
- 6 Tombelaine V, Buy-Lesvigne C, Leproux P, Couderc V and Mélin G 2008 Optical poling in germanium-doped microstructured optical fiber for visible supercontinuum generation Opt. Lett. 33 2011-3
- 7 Malitson I H 1965 Interspecimen comparison of the refractive index of fused silica J. Opt. Soc. Am. 55 1205-9
- 8 Boyd R W 2008 The nonlinear optical susceptibility Nonlinear Optics 3rd edn (Academic Press) pp 1-67

9 Deparis O, Mezzapesa F P, Corbari C, Kazansky P G and Sakaguchi K 2005 Origin and enhancement of the second-order non- linear optical susceptibility induced in bismuth borate glasses by thermal poling J. Non-Cryst. Solids 351 2166-77

10 Shand E B 1941 The dielectric strength of glass-An engineering viewpoint Electr. Eng. 60 814-8

11 Zhu Z and Brown T G 2002 Full-vectorial finite-difference analysis of microstructured optical fibers Opt. Express 10 853-64

12 Ordal M A, Bell R J, Alexander R W, Newquist L A and Querry M R 1988 Optical properties of Al, Fe, Ti, Ta, W, and Mo at submil- limeter wavelengths Appl. Opt. 27 1203-9

13 Shlyagin M G, Khomenko A V and Tentori D 1995 Birefringence dispersion measurement in optical fibers by wavelength scanning Opt. Lett. 20 869-71

14 Keiser G 2000 Power launching and coupling Optical Fiber Communications (McGraw-Hill) pp 204-38

List of potential citation cartel references:

The following references were flagged for potential citation clustering (multiple papers from the same author group); please review their relevance and balance.

1 Tombelaine V, Buy-Lesvigne C, Leproux P, Couderc V and Mélin G 2008 Optical poling in germanium-doped microstructured optical fiber for visible supercontinuum generation Opt. Lett. 33 2011-3

2 Jonard M, Arosa Y, Tonello A, Mansuryan T, Colas M, Cornette J, Duclère J-R, Lefort C and Couderc V 2024 Generation of second harmonic at wide conversion band in GRIN multimode fibers Opt. Commun. 569 130831

3 Ceoldo D, Krupa K, Tonello A, Couderc V, Modotto D, Minoni U, Millot G and Wabnitz S 2017 Second harmonic generation in multimode graded-index fibers: spatial beam cleaning and multiple harmonic sideband generation Opt. Lett. 42 971-4

List of unverified references:

The following references could not be verified in our database or are published in journals not currently indexed in SCOPUS, Web of Science, or DOAJ; please review their suitability.

1 Origin and enhancement of the second-order nonlinear optical susceptibility induced in bismuth borate glasses by thermal poling

2 The dielectric strength of glass-An engineering viewpoint

Detailed Observations

Section-wise analysis of strengths and weaknesses identified in the literature review and evidence integration.

Weakness

Severity: Minor | Confidence: High

Methods: Study design

Citation cluster [8–12]/[9–12] includes tangential integrated-waveguide SHG work

The grouped citations [8–12] and [9–12] are used to support specific claims about optical poling in optical fibers and the $\chi(2)$ values ($\approx 0.1\text{--}0.3 \text{ pm V}^{-1}$) obtainable in such fibers. References [8], [9], and [12] address fiber or graded-index /multimode fiber systems and are plausibly relevant. However, [10] (Singh et al., 2020, Light: Science & Applications 9, 17) and [11] (Billat et al., 2017, Nat. Commun. 8, 1016) concern second-harmonic generation and quasi-phase-matching in silicon and Si3N4 integrated waveguides, not optical fibers. They do not directly document $\chi(2)$ values in optically poled fibers nor the specific voltage/temperature regimes discussed, and thus are only tangential to the fiber-focused quantitative claims. Their inclusion inflates the citation clusters without proportionate evidential value for the stated point, which fits the pattern of mild citation padding. Such padding can give readers an exaggerated impression of the amount of directly supporting fiber-based evidence and weakens the transparency of the literature review. Best practice is to restrict clustered citations to studies that substantively underwrite the precise statement being made, while citing integrated-waveguide work separately when drawing broader platform comparisons.

Excerpt- "Since then, research on $\chi(2)$ creation in optical fibers has focused mainly on the enhancement of nonlinearity or conversion efficiency by electrical field-induced second-order nonlinearity [4–7] or optical poling [8–12] ... In turn, optical poling ... allows similar nonlinearities of 0.1–0.3 pm V^{-1} to be obtained [9–12]."

Recommendation:

Retain the clearly fiber-related references in [8–12]/[9–12], but remove or relocate the silicon and Si3N4 integrated-waveguide SHG papers so that only studies that directly support optical poling and $\chi(2)$ values in fibers are grouped under these citations.

Weakness

Severity: Minor | Confidence: Medium

Methods: Study design

Small citation cartel centered on a narrow author group in SHG fibers

Integrity checks indicate 3 of 26 references ($\approx 11.5\%$) belong to a potential citation cartel involving a recurring author group (e.g. Tombelaine et al. 2008, Jonard et al. 2024, Ceolodo et al. 2017). These works are thematically relevant—covering optical or thermal poling and multimode fiber SHG—but their concentration around one collaboration cluster modestly skews the bibliography toward that group. While not evidence of misconduct on its own, such patterns can bias perceptions of the field by overemphasizing one school's contributions relative to other comparable work. COPE and ICMJE emphasize balanced, impartial citation practices that represent the breadth of significant prior research. A more diversified selection of independent studies on fiber SHG, poling techniques, and nonlinearity enhancement would reduce the appearance of preferential citation and improve the neutrality of the literature review.

Recommendation:

Broaden the bibliography on optical/thermal poling and SHG in fibers by incorporating comparable work from other groups and ensuring that inclusion is driven by conceptual and methodological relevance rather than author overlap.

Methods: Study design

Reference [23] does not clearly match the described 'optical properties database'

The manuscript states that refractive indices of the in-house glasses and tungsten are "accessible in an optical properties database [23]". However, reference [23] is Ordal et al. (1988), which reports optical properties of several metals at submillimeter wavelengths. It is a measurements paper on specific metals, not an optical database that would contain refractive indices for the authors' custom glasses. While it may justify tungsten's optical constants over a limited spectral range, it does not match the broader description of a database for both tungsten and the in-house glasses. This mismatch between the textual claim and the cited source weakens citation accuracy and may confuse readers about the provenance and wavelength range of the material data used in simulations. Accurate, specifically matched citations are important for reproducibility and for enabling readers to verify underlying parameters.

Excerpt- "The measured RI of the in-house glasses and RI of tungsten are accessible in an optical properties database [23]."

Recommendation:

Clarify the role of Ordal et al. (1988)—e.g. cite it explicitly for tungsten optical constants—and, if a different source or database was used for the glass refractive indices, cite that work separately and adjust the text so each reference accurately reflects the data it provides.

● Weakness

Severity: Major | Confidence: High

Methods: Study design

Key recent work on alkali- and soft-glass fiber $\chi(2)$ /SHG is not cited

The introduction motivates alkali-rich, high- $\chi(3)$ soft glasses for electrically induced $\chi(2)$ in fibers and presents the proposed fiber as a significant step beyond silica-based systems. However, several closely related recent studies on second-order nonlinearity and SHG in non-silica and alkali-glass-based fibers are absent. For example, an explicitly aligned analysis of alkali-ion migration and $\chi(2)$ in alkali-glass-based optical fibers (Anuszkiewicz et al., 2025, *Photonics Letters of Poland*, doi:10.4302/plp.v17i3.1356) predicts $\chi(2)$ enhancements versus silica for similar glass families. Tellurite fibers with record SHG efficiencies for non-silica fibers have been demonstrated (e.g. Chen et al., 2019, *Opt. Lett.* 44, 4686, doi:10.1364/OL.44.004686). Electrically poled, hybrid microstructured fibers with infiltrated nonlinear materials have also been reported (e.g. Pissadakis et al., 2019, *IEEE J. Sel. Top. Quantum Electron.*, doi:10.1109/JSTQE.2019.2958995), and GaSe-filled hollow-core fibers show giant SHG enhancement (Li et al., 2023, *Acta Phys. Chim. Sin.*, doi:10.3866/pku.whxb202212028). Omitting such work narrows the reader's view of the rapidly evolving landscape of non-silica and alkali-rich glass fibers for $\chi(2)$ generation and may unintentionally overstate the novelty of using high-alkali, high- $\chi(3)$ glasses for low-voltage, room-temperature SHG. Comprehensive citation of this recent literature is important for accurately contextualizing the contribution, delineating what is experimentally new versus theoretically anticipated, and helping readers understand how the present results compare quantitatively with other non-silica platforms.

Excerpt- "In this paper, we propose a fiber made of soft glass with a $\chi(3)$ value enhanced by a factor of 3.9 with respect to silica and with unique composition, i.e. high alkali metal ions concentration."

Recommendation:

Expand the introduction and discussion to cite recent, closely related work on second-order nonlinearity and SHG in alkali-glass-based, tellurite, and hybrid microstructured fibers (e.g. doi:10.4302/plp.v17i3.1356; doi:10.1364/OL.44.004686; doi:10.1109/JSTQE.2019.2958995; doi:10.3866/pku.whxb202212028) and explicitly compare glass composition, poling conditions, $\chi(2)$ values, and efficiencies with those studies.

● Strength

Confidence: High

Methods: Study design

No retracted or unsupported references detected in the bibliography

Integrity checks report 0 retracted references and 0 unsupported citations among the 26 references. This suggests that the authors have based their work on sources that are, as far as current databases indicate, scientifically valid and that they have avoided citing literature that does not actually support the statements made in the text. Adhering to this standard aligns with good scholarly practice and reduces the risk that the manuscript's conclusions rest on discredited or irrelevant prior work. It also supports transparency and reader confidence in the reliability of the cited background and parameter values.

● Strength

Confidence: High

Methods: Study design

Introduction incorporates several recent high-impact SHG and $\chi(2)$ studies

The introduction situates the work within both traditional and emerging approaches to fiber-based $\chi(2)$ generation. It cites recent, high-impact demonstrations of in-fiber SHG with embedded 2D materials (Ngo et al., 2022, *Nat. Photon.* 16, 769–76, [2]) and high- $\chi(3)$ lead-silicate microstructured fibers (Zhang et al., 2013, *Opt. Express* 21, 31309–17, [13]), alongside more established thermal and optical poling studies [3–7, 8–12]. This shows that the authors are aware of and engaging with state-of-the-art methods beyond classical silica thermal poling, helping readers understand why high-alkali soft glasses are an interesting alternative. Such up-to-date coverage improves the credibility of the motivation and allows for more nuanced comparisons across platforms.

Excerpt- "Recently, Ngo et al [2] proposed a silica-based fiber with a MoS₂ crystal monolayer embedded in an air-exposed core. This allowed a record value of nonlinearity equal to 44 pm V⁻¹ to be reached. Another path is the search for new glass materials ... An example is given by Zhang et al [13] ..."

● Strength

Confidence: High

Methods: Study design

Key models and property data are backed by appropriate foundational citations

Where the manuscript derives nonlinear parameters and design choices from established theory or measurements, it generally cites authoritative sources: Malitson (1965) for fused silica refractive indices [15], Boyd's Nonlinear Optics text for $\chi(3)$ –n₂ relations [16], Deparis et al. (2005) for a Miller's-rule-based scaling of susceptibilities [17], Shand (1941) and Fischer & Schneider (2021) for dielectric breakdown strengths in silica and borosilicates [20, 21], and method papers on birefringence and dispersion measurements [24, 25]. These citations closely match the specific quantities or techniques invoked, supporting reproducibility and accurate interpretation of the estimated $\chi(3)$, n₂, and $\chi(2)$ values. This careful anchoring of formulas and material parameters in standard references enhances the technical reliability of the literature usage in the modeling and characterization sections.

Excerpt- "We have used RI values at wavelengths of 516 nm (2 ω) and 1032 nm (ω), measured for in-house glasses (n) and one reported in the literature for silica glass (n_s) [15]. We have also used a Miller's rule [16] and its adaption by Deparis et al [17] ... Knowledge of the values of $\chi(3)$ and n ... allows estimation of the nonlinear refractive index value n₂ from the formula [16]."



Thank You!

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