Custom Process for Low-Loss Planar Waveguides in Security Applications

AI Overview

Low-loss planar waveguides for security applications can be achieved through careful material selection, optimized waveguide geometry, and CMOS-compatible fabrication processes such as LPCVD, TriPleX, or Photonic Damascene techniques.Materials and Core-Cladding SelectionUltra-low-loss planar waveguides rely on high optical transparency and low scattering materials. Common choices include Si_3N_4-core with SiO_2 cladding or Ta_2O_5-core with SiO_2 cladding, which provide high index contrast and low propagation loss across visible to infrared wavelengths . Ta_2O_5 cores, in particular, allow for enhanced nonlinear optical performance and reduced propagation loss compared to Si_3N_4, making them suitable for high-precision sensing and secure optical communications .Fabrication TechniquesSeveral fabrication processes are used to achieve low-loss waveguides:Low-Pressure Chemical Vapor Deposition (LPCVD): Alternating layers of Si_3N_4 and SiO_2 are deposited to form high-contrast waveguides with low channel attenuation. LPCVD allows precise control of modal birefringence and waveguide geometry, which is critical for minimizing loss in tight bends and cascaded structures .TriPleX Process: A CMOS-compatible process that enables waveguides to operate from visible to infrared wavelengths with channel attenuation $\leq$ 0.06 dB/cm and low insertion loss, suitable for high-density photonic integration .Photonic Damascene Process: Used for Si_3N_4 waveguides, this process reduces sidewall roughness and scattering, achieving ultra-low propagation losses and enabling integration with active components .Design ConsiderationsMinimizing loss requires balancing optical confinement and interface scattering. Key strategies include:Optimizing waveguide cross-section to reduce sidewall scattering while maintaining tight mode confinement .Using annealing and refined core deposition t...

Article Content

Ultra Low Loss Planar Waveguides and Their Applications

Ultra Low Loss Planar Waveguides and Their Applications Abstract: Prospective authors are requested to submit new, unpublished manuscripts for inclusion in the upcoming event described

Fabrication techniques for low loss silicon nitride waveguides

An optimized process was developed for Si_3N_4/SiO_2waveguide manufacturing so as to produce very low loss waveguide devices in a fully operational CMOS fabrication line.

Ultra-Low Loss Si_3N_4 Planar Waveguide Platform and Applications

Ultra-Low Loss Si 3 N 4 Planar Waveguide Platform and Applications Abstract: The ultra low-loss Si 3 N 4 /Oxide on silicon waveguide platform has yielded a wide range of passive and active components

Harnessing the capabilities of VCSELs: unlocking the potential for ...

Key obstacles encompass the high-gain active layer growth in the UV range, the creation of a low-loss microcavity, and the achievement of efficient current injection mechanisms.

Anneal-free ultra-low loss silicon nitride integrated photonics

We demonstrate for the first time, a uniform low temperature (<250 °C) process for fabricating both high-confinement thick and low-confinement thin ultra-low loss Silicon nitride...

Review on the terahertz transmission devices and their applications ...

The novelty of this review lies in its integrative approach, bridging the gap between theoretical developments and practical implementations. Major findings highlight the superior low

Introduction to the Special Issue on Ultralow Loss Planar Waveguides ...

An increasing number of applications require lower planar waveguides losses and advances in materials, waveguide design, processing techniques and monolithic and heterogeneous

Mode-tunable low-loss waveguides in glass for visible light photonic ...

Integrated photonic devices based on Si_3N_4 waveguides allow for the exploitation of nonlinear frequency conversion, exhibit low propagation loss, and have led to advances in compact

An Ultra-Low-Loss (<0.1 dB/m) Planar Silica Waveguide

We demonstrate record low (0.045 dB/m) total propagation loss in silica-on-silicon planar waveguides fabricated with wafer-bonded thermal oxide

Towards monolithic low-loss silicon nitride waveguides on a mature

In CMOS process, low pressure chemical vapor deposition (LPCVD) is one of the common methods to prepare silicon nitride films with low intrinsic loss and good repeatability. The

Optical Planar Waveguide Sensor with Integrated

Optical planar waveguide sensors, able to detect and process information from the environment in a fast, cost-effective, and remote fashion,

Optimization of waveguide fabrication processes in lithium-niobate-on ...

Recognizing the pivotal role of addressing these fabrication challenges for obtaining low-loss WGs, our research focuses on a systematic study of various process steps in fabricating LNOI

Low losses Er3+-doped flexible planar waveguide: Toward an all-glass ...

In this paper an effective top-down route is developed to fabricate SiO 2 –HfO 2:Er 3+ planar waveguides with mechanical flexibility and low optical losses via RF-sputtering.

Low-loss optical waveguides made with a high-loss material

Planar waveguides with low loss that are fully compatible with existing photonic circuit fabrication techniques are missing. Furthermore, it has been overlooked that such waveguides

Ultra-low loss SOI waveguide crossings designed by a hybrid global ...

Abstract We demonstrate an ultra-low loss single-mode silicon waveguide crossing and an ultra-compact and ultra-low loss polarization-insensitive silicon waveguide crossing using a hybrid

Optical meta-waveguides for integrated photonics and beyond

Brief physical fundamentals with explicit design methods and representative applications for meta-waveguides are comprehensively summarized.

Additive manufacturing of planar waveguides for

Abstract and Figures The emerging planar photonic crystal (PC) and effective medium (EM) waveguides are considered promising technical platforms

Ultra-Low-Loss Silicon Waveguides for

Integrated ultra-low-loss waveguides are highly desired for integrated photonics to enable applications that require long delay lines, high-Q resonators, 250C Process for < 2dB/m Ultra-Low Loss Silicon Nitride Integrated ...

We describe the process and test and measurement results, and compare them with LPCVD nitride, and the potential for future use of this process technology.

Low loss, high contrast planar optical waveguides

Abstract A new class of integrated optical waveguide structures ("TriPleX") is presented, based on low cost CMOS-compatible LPCVD

Low-loss optical waveguides made with a high-loss material

Based on subwavelength gratings, here, we show that it is possible to create broadband, multimode waveguides with very low propagation losses despite using a strongly absorbing material.

Low-loss planar optical waveguides fabricated from polycarbonate.

For low-loss optical waveguides, a promising polymer must be almost apparent at the communication wavelength range. Thus, we measured the absorption spectrum of the fabricated

arXiv:2408.06688v1 [physics.optics] 13 Aug 2024

yabinsk 454080, Russia (Dated: August 14, 2024) We report low-loss multiscan waveguides fabricated in fused si. ica using femtosecond laser writing technology. The multiscan

250C Process for < 2dB/m Ultra-Low Loss Silicon Nitride Integrated ...

In this work, we present the first demonstration of ultra-low losses of 2.0dB/m in silicon nitride waveguides and ring resonators with Q = 11.18 million, using a anneal-free process involving ICP

Introduction to the Special Issue on Ultralow Loss Planar Waveguides ...

Two invited papers cover important history and developments of low loss silicon nitride waveguides, the Photonic Damascene process and the TriPleX process.

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