Introduction to the Special Issue on Ultralow Loss Planar Waveguides and Their Applications

WELCOME to the IEEE JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS (JSTQE) Special Issue on **Ultra Low Loss Planar Waveguides and Their Applications**.

Ultra-low loss optical planar waveguide technology is a critical research area driven by the need to improve energy efficiency and advance the power handling capability, performance, function and complexity of photonic integrated circuits and systems-on-chip. An increasing number of applications require lower planar waveguides losses and advances in materials, waveguide design, processing techniques and monolithic and heterogeneous integration. Low loss operation from the visible to the infrared and passive and active waveguide structures as well as linear and non-linear optical devices are needed. Examples of applications driving these advancements include data-communications, bio-sensing, positioning and navigation, low noise microwave synthesizers, spectroscopy, RF signal processing, quantum communication, and atomic clocks.

The special issue comes at an important stage in low loss waveguides and photonic integration and the purpose is to demonstrate the current state-of-the-art in the area of this technology and highlight recent progress and trends to lower waveguide loss, as the key element to realize new functions and their potential applications. This issue brings together 8 invited and 7 contributed papers, authored by world-renowned research groups and scientists, on this topic of ever increasing importance.

The invited papers present significant reviews of state-of-the art in ultra-low loss waveguide technology and applications and perspectives on future prospects and research directions. Two invited papers cover important history and developments of low loss silicon nitride waveguides, the Photonic Damascene process and the TriPleX process. The remaining invited papers cover important areas of linear and nonlinear optical applications across the visible to mid-infrared, scaling low-loss silicon photonic waveguides to 300-mm wafers for large-scale integration, nonlinear optical frequency micro-combs and their application to RF photonics, low-loss compact lithium niobate electrooptic modulators, trimming low-loss silicon micro-ring resonators for frequency alignment, and polymer waveguides for low loss coupling to silicon waveguides. The contributed papers cover low-loss fabrication techniques using atomic layer deposition (ALD), the use of on-chip Bragg Gratings to measure low optical waveguide losses, device papers on tunable low loss wavelength-flattened directional couplers and high-performance integrated optical resonator circuits and their applications, and large non-linearity Ge-Sb-Se low-loss glass based photonic devices for near-infrared operation. The special issue also includes contributed papers that highlight applications, i.e., low-loss silicon nitride waveguides for optical beamforming networks and continuously tunable optical true time delay using silicon nitride ring resonators.

We hope you will find this JSTQE Issue on Ultra Low Loss Planar Waveguides and Their Applications to be an interesting and useful reference that will impact, stimulate and promote further advances in lowering planar waveguide losses and enable next generations of photonic integration and system-on-chip applications.

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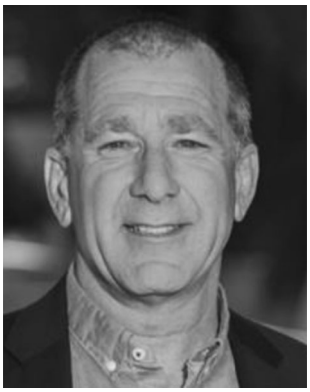

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