1. Introduction

Silicon nitride-based waveguides form a promising, CMOS-compatible platform in integrated photonics research [1]. Especially, stoichiometric silicon nitride (Si_3N_4) deposited using low-pressure chemical vapor deposition (LPCVD) offers extremely low intrinsic losses and superior reproducibility. Further advantages of this platform are a broad transparency ranging from the visible [2] to the mid-infrared, a high index contrast and absence of two-photon absorption in the near-infrared, including all the telecommunication bands. Due to their low propagation losses in the C-band as well as their low coupling losses by using spot-size converters Si_3N_4 waveguides are favored in the field of microwave photonics [3, 4] and for novel types (glass-semiconductor) lasers with record low spectral bandwidth [5, 6]. Furthermore, ultra-low propagation losses in the C-band of 0.32 dB/m have been demonstrated with weakly confined modes using 40 nm thin Si_3N_4 waveguides [7, 8]. The low confinement of the mode, however, has the drawback of increased bending losses and, as a consequence, limit the density of devices in integrated circuits. Further applications of Si_3N_4 waveguides are, e.g., bio-chemical applications such as optical coherence tomography [9] and lab-on-a-chip devices due to the compatibility of Si_3N_4 waveguides with microfluidic channels [10, 11].

Furthermore, Si_3N_4 waveguides are of high interest for nonlinear integrated photonics [1] due to their high Kerr index [12], while supporting highly confined modes due to their high index contrast and lacking nonlinear losses in the near-infrared. Nonlinear effects such as supercontinuum generation [13] and parametric frequency comb generation [14] have been demonstrated. For the latter, huge potential in nonlinear optical signal processing was shown by transmitting a data stream of 1.44 Tbit/s [15]. It is desirable to select the waveguides such that the pump wavelength for broadband wavelength conversion lies in the spectral region where laser sources are readily available, i.e. 1000 to 2000 nm. However, to obtain phase matching for broadband wavelength conversion, the dispersion of the waveguide must be engineered such that pump wavelength is in the anomalous dispersion regime, while also being close to the zero dispersion wavelength (ZDW).

To achieve high modal confinement and to shift the ZDW to the near-infrared, the