



Fig. 7. Conversion Efficiency dependence on n_g at λ_{pump} for different propagation loss n_g scaling factors: $\alpha^* = \alpha_0 (n_g/n_0)^\delta$; $\delta = \sqrt{2}/2$ (dash), $\delta = 1$ (solid), $\delta = \sqrt{2}$ (dot), $\delta = 2$ (dash-dot), measurement (solid points).

5. Conclusion

We have experimentally investigated the group index enhancement of four-wave mixing in a W1 silicon photonic crystal waveguides. A 0.44 mm long waveguide exhibited a maximum conversion efficiency of -36 dB using a coupled pump power of 14 dBm. Over the wavelengths examined a group index enhancement of the third-order nonlinearity resulting in the conversion efficiency was to increase by over 12 dB from a $\Delta n_g \approx 55$. A corresponding decrease in the conversion efficiency bandwidth, from 5 nm to 0.5 nm, was also observed, which would severely limit the utility of the device in regard to most known applications of FWM in conventional silicon waveguide. Both of these experimental observations match well with a simple numerical model of four-wave mixing in photonic crystal waveguides which accounts for group index scaling of the propagation loss and nonlinear. The results presented here reinforce the slow-light nonlinear enhancement possible within silicon photonic crystal waveguides.

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