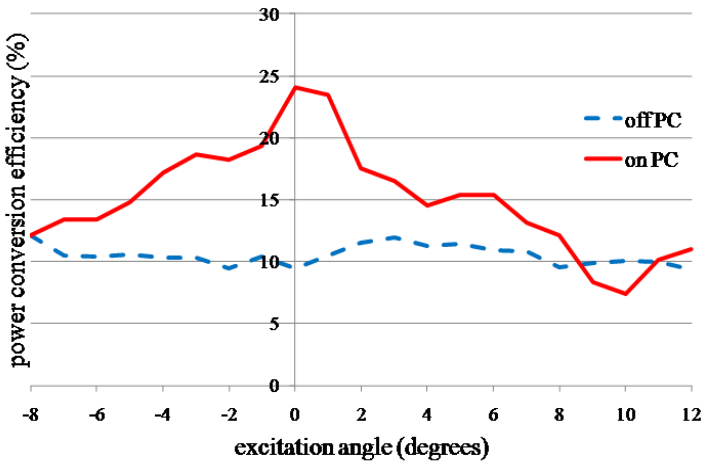

Fig. 11. Power conversion efficiency measured using an integrating sphere and at varying excitation angles. The PC improves the conversion efficiency over 2.5x through the enhanced excitation effect.

6. Conclusion

We demonstrated the design, fabrication, and characterization of a 2D asymmetric PC engineered to improve the conversion efficiency of optical down conversion of PbS QD from the blue to NIR wavelengths. Using a nanoreplica molding process that can potentially scale up to large areas and flexible substrates, we fabricated PC with embedded QD. Both enhanced extraction and enhanced excitation effects were simultaneously possible at wide wavelength separation due to the 2D asymmetric PC design. Coupling to leaky modes of the PC, enabled enhanced extraction effect that preferentially coupled QD emission light out of the PC into controlled directions. This is important for directing light to other optical elements. Furthermore, the enhanced excitation effect was observed when the excitation light was at a resonant condition. This increased the emission intensity and improved the conversion efficiency in comparison to QD embedded in non-structured polymer.

Acknowledgments

The research was supported by BAE Systems IRAD under project manager James M. Ortolf, and the authors acknowledge James M. Ortolf for many helpful discussions.

#139110- $15.00USD Received 3 Dec 2010; revised 3 Feb 2011; accepted 9 Feb 2011; published 14 Feb 2011