Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Reversible Shape Memory Optical Gratings QIAOXI LI, CARY TIPPETS, YULAN FU, Univ of NC - Chapel Hill, EUGENE DONEV, Sewanee: The University of the South, SARA TURNER, VALERIE ASHBY, RENE LOPEZ, SERGEI SHEIKO, Univ of NC - Chapel Hill — Recent advancements in the understanding of the mechanisms that control shape memory in semi-crystalline polymers, has led to the development of protocols that allow for reversibility in complex shape transformations. The shifting between two programmable shapes is reversible without applying any external force. This is made possible by thermodynamically driven relaxation of extended polymer chains on heating is then inverted by kinetically preferred pathways of polymer crystallization on cooling. Reversible shapeshifting was applied to modulation of photonic gratings to create hands-free reversibly tunable optical elements. We have fabricated a sub-micron ratio optical square grating that presents reversible magnitude changes of its diffraction intensity (up to about 38% modulation) when subject to changes in temperature. This result is attributed to programmable changes in the grating height due to reversible shape memory and is repeatable over multiple cycles. Besides, roughness-induced variations in scattering signal observed upon heating-cooling cycles may offer another way to monitor kinetics of polymer melting and crystallization. Grants: NSF DMR-1407645,

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Date submitted: 14 Nov 2014 Electronic form version 1.4