

Abstract Submitted
for the DAMOP10 Meeting of
The American Physical Society

Ultra Smooth Microfabricated Mirrors for Atom Chip Based Cavity QED THOMAS LOYD, FRANCISCO BENITO, GRANT BIEDERMANN, KEVIN FORTIER, DANIEL STICK, PETER SCHWINDT, MATTHEW BLAIN, Sandia National Laboratories — Microfabricated optical cavities are an attractive system for atomic physics research. When paired with an atom the small mode volume can lead to strong atom-cavity coupling with only a modest finesse. Such systems are of significant interest for applications in quantum information [1]. While experiments using a single cavity or a small number of cavities tend to be tractable, scaling the number of cavities required for a useful quantum network remains challenging [2]. In this work, we have developed an ultra high reflectivity micro-mirror for scalable quantum information systems taking the work of Trupke et al. [3] as a starting point. We have demonstrated that our micro-mirror fabrication technique produces ultra smooth mirror surfaces of 2.2 Angstroms rms. Optical cavities formed with these mirrors exhibit a high finesse of over 60,000 leading to a calculated single atom cooperativity of more than 200. These cavities are attractive candidates for integrated cavity QED experiments and quantum information processing on an atom chip platform. [1]. P K. Vahala, ed., *Optical Microcavities*, (World Scientific, Singapore, 2004). [2]. H. J. Kimble, *Nature*, **453**, 1023 (2008). [3]. M. Trupke, E. A. Hinds, S. Eriksson, E. A. Curtis, Z. Muktadir, E. Kukharenka, and M. Kraft, *Appl. Phys. Lett.*, **87**, 211106 (2005).

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Date submitted: 21 Jan 2010

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