

Hydrogen-beam induced deposition of platinum and tungsten microstructures

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Focused ion beam-induced deposition (IBID) is a popular technique for rapid, direct-write nano- and micro-fabrication. To date most commercial FIB systems are equipped with gallium liquid metal ion sources. The choice of Ga^+ as the ion beam allows substrate sputtering at high current as well as material deposition at low currents via IBID. However, Ga^+ based micromachining suffers from the inherent limitation of Ga implantation into the deposited structure, which may be undesirable for some applications.

FEI recently introduced a FIB system utilizing an inductively coupled plasma source (ICPS).¹ These new tools allow the use of different ions as the primary beam.^{2,3} We have modified an FEI Vion system to run with a plasma consisting of H_2 gas, producing a focused primary beam of $\text{H}^+/\text{H}_2^+/\text{H}_3^+$ at the sample.

In this contribution we report on the use of the focused hydrogen primary beam for deposition of platinum and tungsten microstructures from MeCpPtMe_3 and $\text{W}(\text{CO})_6$ precursor gases respectively. Examples of typical deposition morphologies will be presented as well as cross-sectional and compositional analysis. Strategies for obtaining microstructures with highly pure platinum using the focused hydrogen beam will be discussed.

¹ www.fei.com/products/fib/vion

² M. M. Taklo, A. Klumpp, P. Ramm, L. Kwakman, and G. Franz, *Microsc. Anal.* 114, 9 (2011)

³ C. E. Otis, A. Graupera, D. Laur, S. Zhang, S. Kellogg, and G. Schwind, *J. Vac. Sci. Technol.*, B 30, 06F604 (2012)

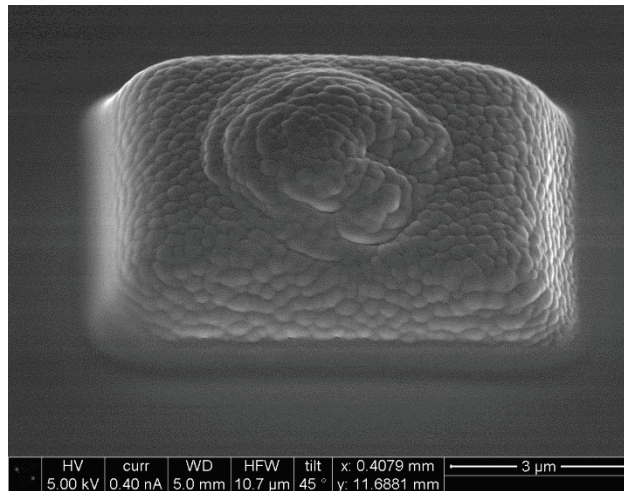


Figure 1: Platinum deposition performed at 30kV, 2.5nA with $H^+/H_2^+/H_3^+$.

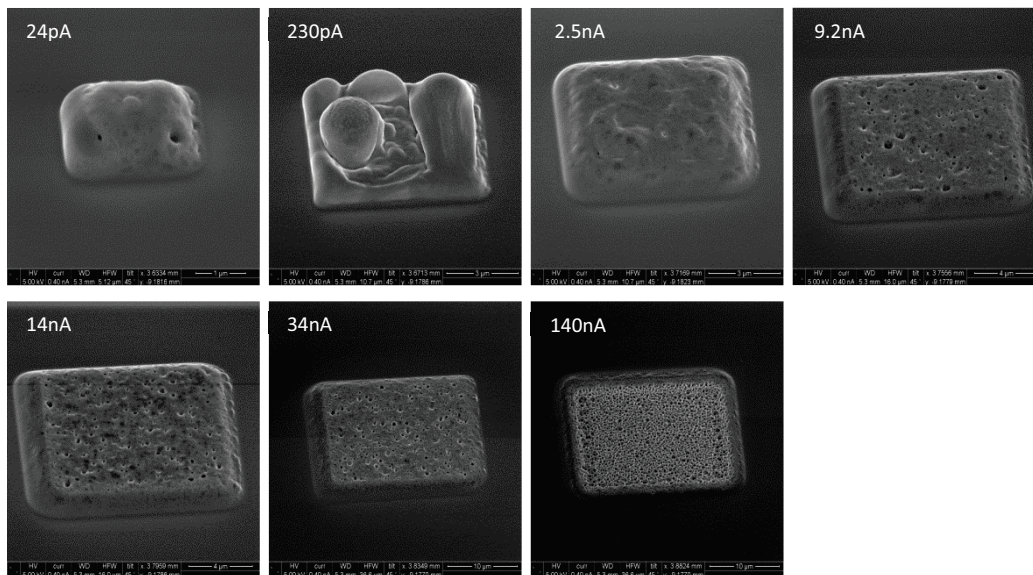


Figure 2: Set of platinum depositions performed at 30kV with $H^+/H_2^+/H_3^+$.