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Minimum stable height of Ag nano-islands on Si(111)7x7 YIYAO CHEN, MICHAEL GRAMLICH, SHAWN HAYDEN, PAUL MICELI, University of Missouri-Columbia — The origin of a minimum stable Ag nano-island height of one bi-layer on top of the wetting layer has remained a long-standing mystery in the effort to understand mechanisms that control the growth of supported nanoscale metals. We present the results of synchrotron x-ray scattering studies which demonstrate that the interfacial energy, rather than previously suspected electron confinement effects, is responsible for the minimum island height. In situ measurements of x-ray reflectivity and crystal truncation rods reveal that the Ag nano-islands consume the wetting layer and are, therefore, tri-layers – an effect that cannot be detected by scanning probe measurements. These experiments lead to an energy "phase diagram" that we propose to explain the existence of a minimum island height for supported nanoscale metals. Support from the National Science Foundation under grants DMR-0706278 and DGE-1069091 is gratefully acknowledged. The Advanced Photon Source Sector 6 beam-line at Argonne National Laboratory is supported by the US-DOE under Contract No. W-31-109-Eng-38.

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