Supporting Information

The Mechanical Properties of Molybdenum Disulfide and the Effect of Doping: an In Situ TEM Study

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**Figure S1.** PXRD pattern of undoped molybdenum disulfide as deposited by AACVD at 450 °C.

**Figure S2.** PXRD pattern of 10% Cr-doped molybdenum disulfide as-deposited at 450 °C by AACVD.
**Figure S3.** pXRD pattern of 50% Cr-doped molybdenum disulfide as deposited at 450 °C by AACVD.

**Figure S4.** TEM image of MoS$_2$/Ni/SiO$_2$/Si pillar prior to compression. Scale Bar: 500 nm.
Figure S5. TEM image of [10% Cr:MoS$_2$]/Ni/SiO$_2$/Si pillar prior to compression. Scale Bar: 500 nm.
Figure S6. TEM image of [50% Cr:MoS₂]/Ni/SiO₂/Si pillar prior to compression. Scale Bar: 500 nm.
Figure S7. Time-lapse images of micromechanical compression tests; a stratified pillar of MoS$_2$:Ni:SiO$_2$:Si (bottom to top) of a diameter in the order of 100-500 nm is compressed at a constant rate of displacement by a Hysitron PicoIndenter tip during bright field TEM imaging. The scale bars in all figures represent 500 nm and apply to all images. Frames are taken ~60s apart from a continuous video. Load/displacement/time curves are displayed such that the black line represents the load and the red line represents the Picoindenter displacement. (a) Tip comprised of MoS$_2$ (b) A typical load/displacement/time curve for MoS$_2$ (c) Tip comprised of 10 at% Cr doped MoS$_2$ (d) A typical load/displacement/time curve for 10 at% Cr doped MoS$_2$ (e) Tip comprised from 50 at% Cr doped MoS$_2$ (f) A typical load/displacement/time curve for 50 at% Cr-doped MoS$_2$. 
Figure S8. TEM images of (A-B) undoped MoS$_2$, (C-D) 5% Cr doped MoS$_2$, (E-F) 20% Cr doped MoS$_2$, and (G-H) 50% Cr doped MoS$_2$. Scale bar: 40 nm. The arrows in the image indicate the width of a crystalline domain. Increasing Cr concentration leads to increased porosity. The size of the MoS$_2$ crystallites increases with the addition of 5% Cr and further additions refine the crystallite size.