

Figure 1. XPS chemical components of (a) HF cleaned Si and (b) degreased SiON at each experimental step of MoF<sub>6</sub> and Si<sub>2</sub>H<sub>6</sub> saturation doses at 120°C. MoF<sub>6</sub> and Si<sub>2</sub>H<sub>6</sub> showed self-limiting behavior on HF cleaned Si. Degreased SiON showed inherent non-reactivity for both MoF<sub>6</sub> and Si<sub>2</sub>H<sub>6</sub>. XPS peaks of (c) Si 2p and (d) Mo 3d after a MoF<sub>6</sub> saturation dose and 1 pulse of Si<sub>2</sub>H<sub>6</sub> on HF cleaned Si. One saturation cycle of MoF<sub>6</sub> and Si<sub>2</sub>H<sub>6</sub> showed the Mo 3d peak position at 227.4 eV which was consistent with a monolayer of MoSi<sub>2</sub> formation.

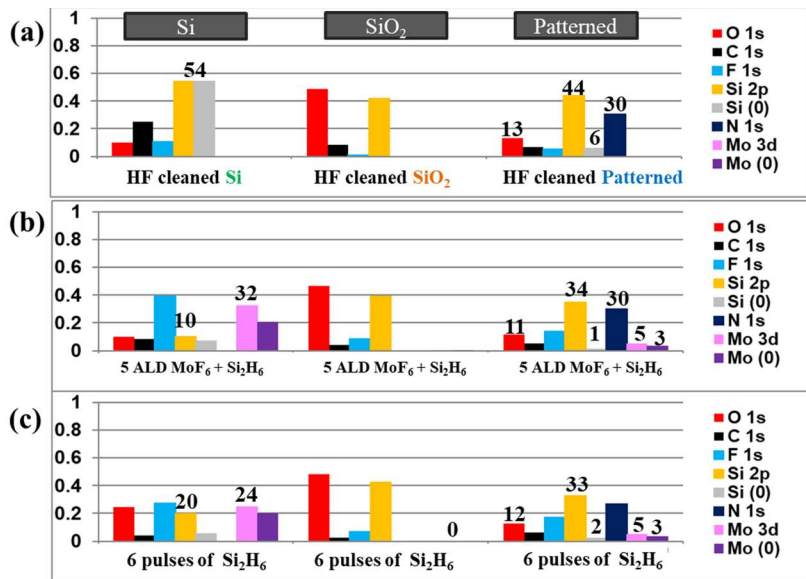


Figure 2. Selective deposition of MoSi<sub>x</sub> on a patterned sample and additional incorporation of Si from extra Si<sub>2</sub>H<sub>6</sub> pulse. (a) As loaded HF cleaned Si, SiO<sub>2</sub> and patterned sample. (b) Selective deposition of sub-stoichiometric MoSi<sub>x</sub> on Si and Si portion of a patterned sample. (c) Additional Si into MoSi<sub>x</sub> film by pulsing Si<sub>2</sub>H<sub>6</sub>.

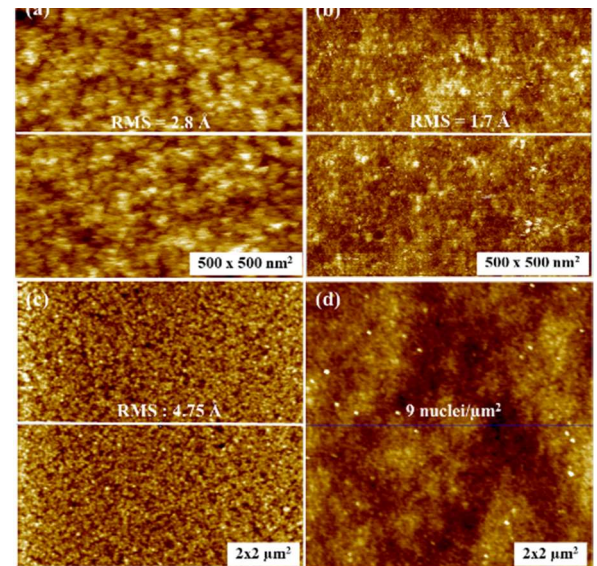


Figure 3. Surface morphology of Si (a) after MoSi<sub>x</sub> ALD, (b) after the 500°C anneal for 3 mins, and (c) after the 900°C spike anneal. The surfaces were smooth and atomically flat. (d) SiO<sub>2</sub> surface was clean with a few MoSi<sub>x</sub> nuclei.

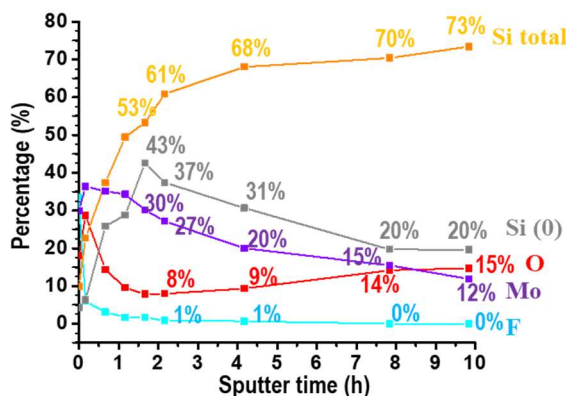


Figure 4. Depth profile XPS coupled with Ar<sup>+</sup> sputtering. The bulk of MoSi<sub>x</sub> film was Si abundant (x=1.4) with <10% O and F. O increased closer to the substrate showing the interfacial oxide layer between the MoSi<sub>x</sub> film and Si substrate.

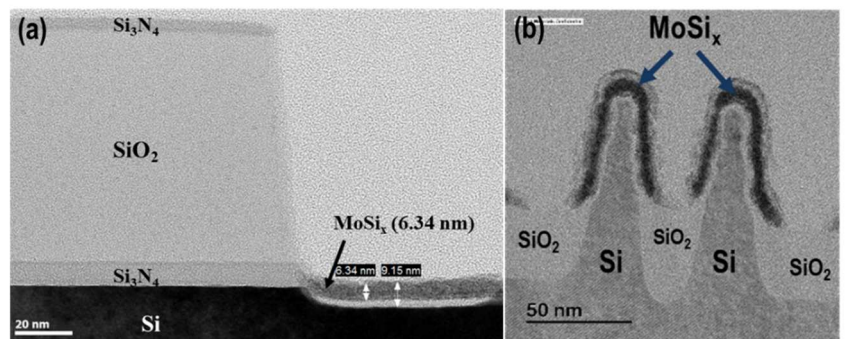


Figure 5. Cross-sectional TEM image of the patterned samples after the selective MoSi<sub>x</sub> deposition. (a) MoSi<sub>x</sub> was selectively deposited on Si after the 5 ALD cycles followed by additional Si from Si<sub>2</sub>H<sub>6</sub>. Plane structured SiO<sub>2</sub> and Si<sub>3</sub>N<sub>4</sub> were inherently non-reactive to MoSi<sub>x</sub> ALD. (b) Selective deposition of MoSi<sub>x</sub> was also achieved on 3D nanostructured Si over SiO<sub>2</sub>.