

Supporting information

Area-selective Ru ALD by amorphous carbon modification using H plasma: from atomistic modeling to full wafer process integration.

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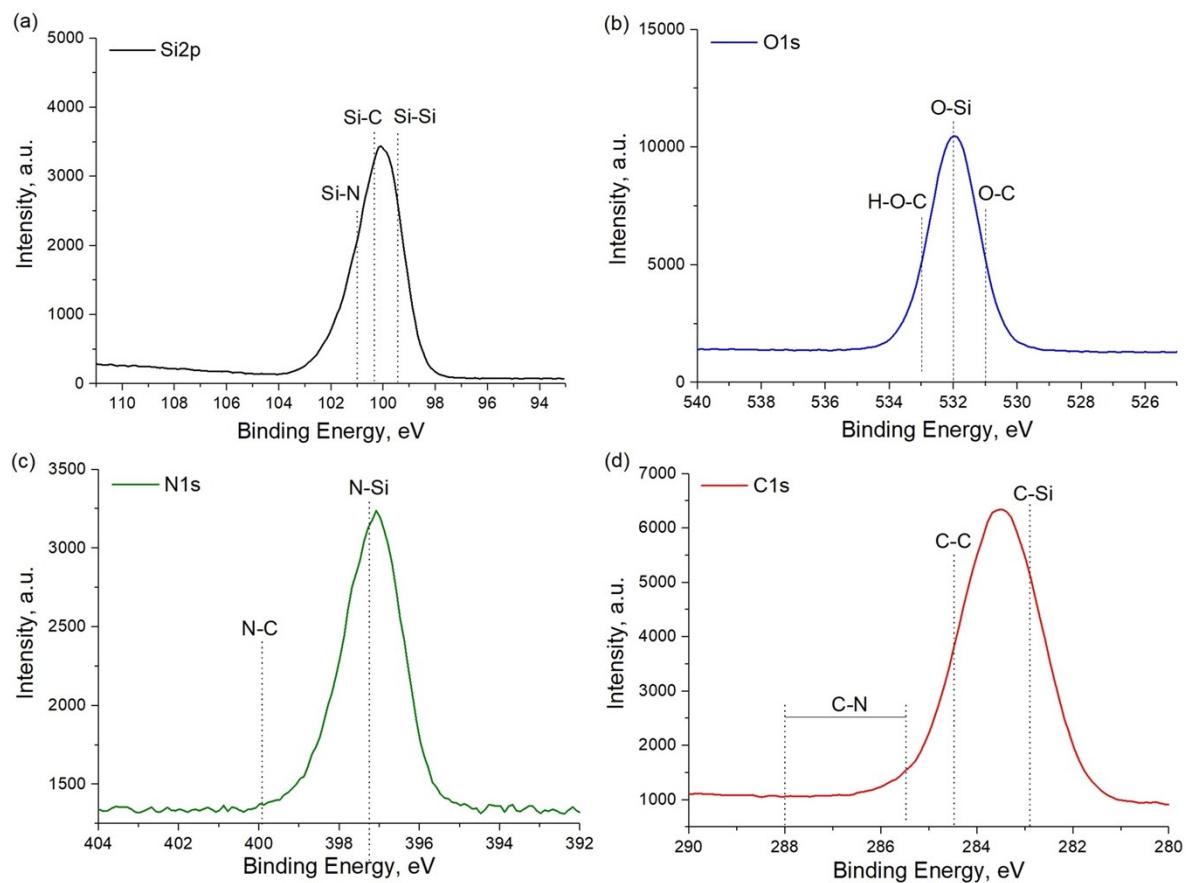


Figure S1. (a) Si2p, (b) O1s, (c) N1s and (d) C1s high-resolution XPS spectra on as deposited SiCN. Water contact angle of as deposited SiCN is 74.9 ± 1.1 degrees.

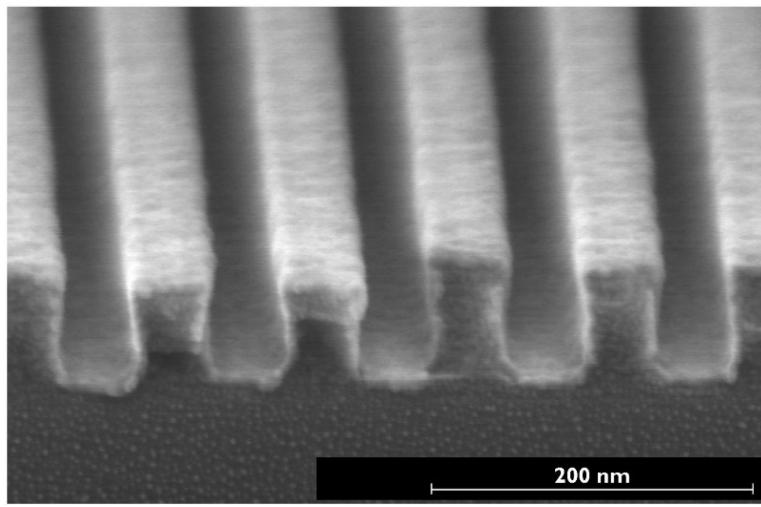


Figure S2. Cross-sectional images of a-C lines formed by H_2/N_2 CCP plasma after 100 cycles of Ru ALD at 275 °C as measured by SEM.

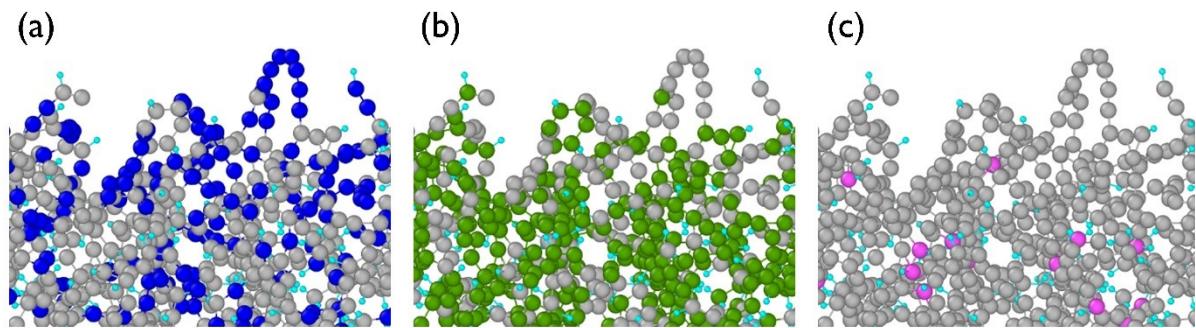


Figure S3. Side view images of the upper a-C layer modified by H ions with fluence of $3.2 \times 10^{16} \text{ cm}^{-2}$. C atoms with (a) sp , (b) sp^2 and (c) sp^3 hybridizations are indicated by blue, green and purple colors respectively.

Similar results were observed by V. Martirosyan et al. for the Si crystal modification in H ions studied by MD simulations.¹ Hydrogenation of Si is reported for the Si bulk and not for the Si surface. However, it should be noted that in the simulation of a-C modification with H ions no saturation of H content was observed, and the steady state was not achieved (reported saturation fluence for silicon is $3.2 \times 10^{16} \text{ cm}^{-2}$).

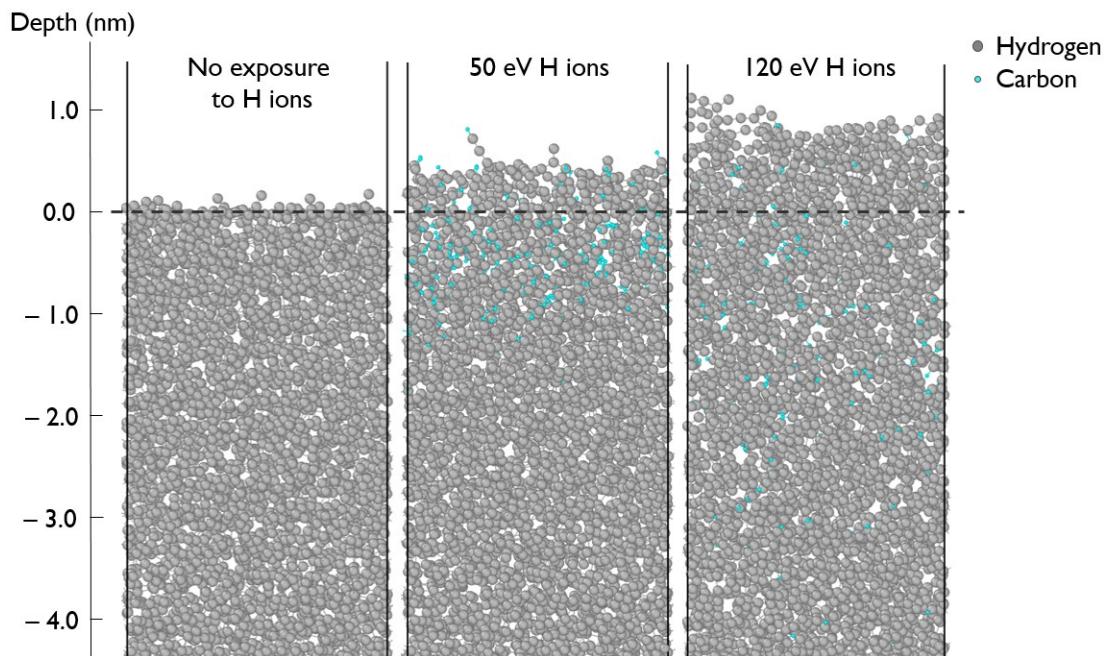


Figure S4. Cross-sectional images of the a-C layer modified by 50 eV H ions (100 W) and 120 eV H ions (300 W) at the fluence of $8 \cdot 10^{15} \text{ cm}^{-2}$

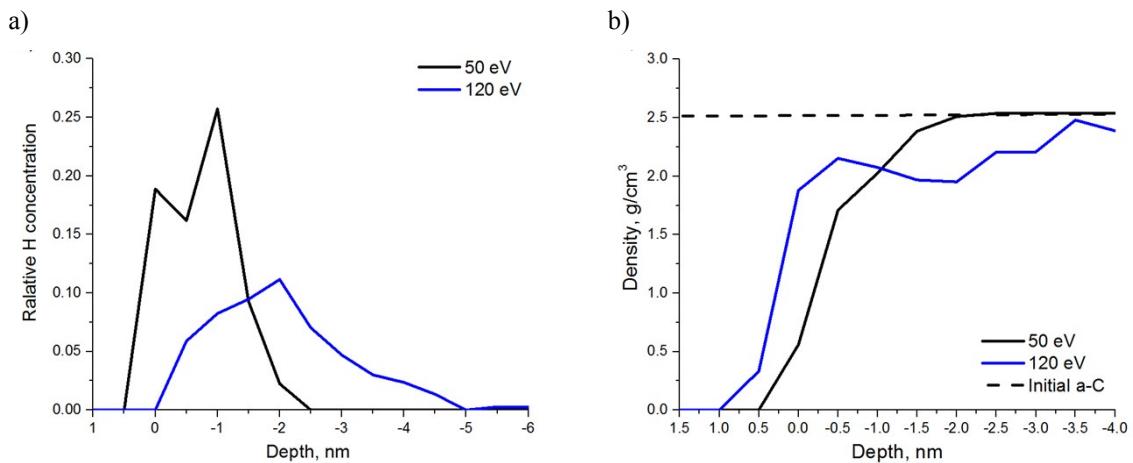


Figure S5. Depth profiles of (a) relative H concentration and (b) a-C density after exposure to H ions at 50 eV and 120 eV with the ion fluence of $8 \cdot 10^{15} \text{ cm}^{-2}$.

References:

- (1) Martirosyan, V.; Joubert, O. Modification Mechanisms of Silicon Thin Films in Low-Temperature Hydrogen Plasmas. **2019**. <https://doi.org/10.1088/1361-6463/aaefe0>.