

Description of Additional Supplementary Files

Supplementary Movie 1 - *In situ* atomic-scale observation of oxidation process at the (111) and (001) surface of Ni-5Cr alloy beside one TB at 350 °C and $pO_2 \sim 1 \times 10^{-4}$ mbar. The movie was sped up 5 times.

Supplementary Movie 2 - *In situ* atomic-scale observation of oxide growth at the (111) surface of Ni-5Cr alloy at 350 °C and $pO_2 \sim 1 \times 10^{-4}$ mbar. The movie was sped up 10 times.

Supplementary Movie 3 - *In situ* atomic-scale observation of two layers oxide growth at the (001) surface of Ni-5Cr alloy at 350 °C and $pO_2 \sim 1 \times 10^{-4}$ mbar. The movie was sped up 20 times.