# Supplementary data

**Superfluous Oxygen Diffusion Induced** **Amorphization of ZrC0.6O0.4 and Transformation of Amorphous Layer under** **Electron Beam Irradiation**

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**Abstract:** On the powder surface of oxygen-ordered ZrC0.6O0.4 obtained *via* isothermally heating of vacancy-ordered ZrC0.6 at 300oC, an amorphous ZrC0.6O*y*>0.4 layer in nanoscaled thickness is found to form if the heating lasts long enough. With the help of HRTEM and SAED measurements, the amorphous formation is recognized to originate from diffusion of superfluous oxygen atoms into Zr-tetrahedral centers in the surface area, thus leading to severe distortion of lattice. *In* *situ* investigation of HRTEM, SAED, and EELS demonstrates that under electron irradiation of sufficient dose, the amorphous ZrC0.6O*y*>0.4 layer transforms to a cubic ZrO2 layer with the same orientation as the underlying ordered ZrC0.6O0.4.

*Keywords*: Compound; Oxidation; Transmission electron microscopy(TEM)



**Figure S1**. The XRD patterns at room temperature for the ordered ZrC0.6 and the samples obtained after the isothermally heating treatments of the ordered ZrC0.6 in air at 300 oC for 1000 min and 350 oC for 400 min.