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P3.122 Stability of Be-based coatings under annealing up to 1273 K

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Erosion, co-deposition of impurities and heat load effects leads to compound formation in PFC enhancing delamination mechanisms with re-emission of dust particles detrimental to the plasma stability of fusion devices. Beryllium (Be) and tungsten (W) PFC were used in the first wall and divertor in JET, and carbon (C) has achieved new relevance as impurity in the same reactor. Earlier investigations of compound formation were typically performed in the absence of oxygen (O). Nevertheless, the formation of significant BeO contents is also detrimental to the mechanical integrity of mixed layers and should be considered in face of possible accidental O gathering in large reactors as in ITER.

We investigated the formation of compounds and the mechanical integrity of coatings within the Be-C-O and Be-W-O systems under annealing up to 1273 K with atmospheric base pressures close to 1 x 10-7 mbar, making use of electron microscopy, ion beam, X-ray diffraction and nano-indentation techniques. In the Be-C-O system the formation of Be2C and BeO is enhanced at temperatures higher than 873 K, leading to the huge delamination of C thin coatings deposited on Be plates and to a smooth delamination behaviour of metallic Be deposited on graphite.

The Be-W-O system was initially investigated by depositing W and Be coating on Be and W plates, respectively, being the formation of BeO, Be2W and mainly Be12W identified at 1073 K. Remarkably, the growth of berylides promotes the mechanical stability in the coatings. Even the recovery of localized delamination events in Be films occurred at 973 K was observed at 1073 K.

In opposition to the case of Be2W and Be12W, the growth of Be22W was induced by annealing Be:W layers deposited on Be plates at 1173 and 1273 K, leading to a huge mechanical failure in both films.

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