OR1402

Atom probe tomography characterization of the decomposition in austenitic stainless steels 304L and 316L induced by low temperature plasma nitriding

Andrius Martinavičius[1], Raphaële Danoix[1], Frédéric Danoix[1], Gintautas Abrasonis[2], Michel Drouet[3], Claude Templier[3], Béatrice Hannoyer[1]

[1]Université de Rouen, ST Etienne du Rouvray, France [2]Helmholtz-Zentrum Dresden - Rossendorf, Dresden, Germany [3]Institut PPRIME, UPR 3346, CNRS, Université de Poitiers, Futuroscope-Chasseneuil, France

andriusmart@gmail.com

Nitriding of austenitic stainless steel (ASS) at moderate temperatures (~400°C) leads to the formation of a modified layer which shows increased hardness and induced magnetism without compromising the corrosion resistance. In this study, a three-dimensional atomic characterization of plasma nitrided ASS 304L and 316L has been achieved with atom probe tomography (APT). While only a single phase, usually called the S phase or expanded austenite, can be detected by the X-ray diffraction, the APT reveals the formation of nanometric CrN precipitates. The precipitates have irregular oblate-spheroid-like shape. Small CrN clusters of only few nanometers in diameter have been observed close to the nitrided layer-steel interface as well as close to the surface. The regions which have been under nitrogen supersaturated conditions during the entire process, i.e. the regions close to the surface, exhibit also larger precipitates with a diameter more than 10 nm. In addition, preferential precipitation of CrN precipitates at grain boundaries and dislocations has been observed. These observations suggest that incorporation of large amounts of N provides strong driving force for CrN formation even at 400°C, a rather low temperature.

Keywords
austenitic stainlees steel
nitriding
atom probe tomography
CrN
precipitation