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# Analysis of In Situ XRD Measurements for Nitriding of fcc Metals (Invited talk)

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## Abstract

The formation of expanded austenite after nitrogen insertion into austenitic stainless steel, CoCr or Ni base alloys is still not completely understood. Ex situ investigations, which can be very sophisticated nowadays, lack the exact time evolution while additional annealing processes may occur during cooling phases. Furthermore a time resolution of a few minutes is required, necessitating modern detectors. After mastering the challenge of building such equipment, in situ experiments can lead to a multitude of information which can be used to reassess current models. Here, detailed insights into microscopic processes are presented for the model system "nitrogen into fcc metals", allowing validation of theoretical models and yielding further questions. The information from the substrate reflexes can be used to directly assess time dependent diffusion processes, which may depend on temperature, voltage or current density. As a corollary, the intensity of the expanded peak should follow this diffusion rate. Deviations can be rapidly identified while direct causation from either decay into CrN, plastic deformation or creation of dislocations is not straight forward. On the other hand, deconvolution of the depth integrated information identifies several open questions even with the aid of nitrogen depth profiles and in-situ stress measurements: (i) structure factor of expanded austenite; (ii) peak width strongly depending on process and not on nitrogen concentration or concentration gradient; (iii) dynamic annealing and reorientation; (iv) decomposition of metastable expanded austenite.

**Keywords:** In situ XRD, LEII, nitriding, fcc metals

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