Unveiling the Origin of Segregation-assisted Hardening in CoCrNi-Alloys with Varying Mo Content Using Correlative TEM/APT Microscopy

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Correlative microscopy techniques as the combination of transmission electron microscopy (TEM) and atom probe tomography (APT) are capable of revealing deeper insights in segregation processes of solute alloying elements towards planar defects in low stacking fault energy alloys. Detailed knowledge concerning segregation effects therefore facilitates further tailoring of mechanical properties.

This work investigates the secondary hardening mechanism by Mo-segregation in CoCrNi based alloys. Derivatives of the commercial alloy MP35N (35Co-35Ni-20Cr-10Mo) with varying Mo content (Fig. 1a) were studied since Mo modifies the stacking fault energy. Secondary hardening in cold rolled and additionally heat treated samples, further improves the tensile strength up to 2400 MPa for the highest Mo content. TEM characterization of the observed planar defects (Fig 1b) and APT measurements of the local chemical composition were used highlight the influence of elemental segregation on the mechanical properties.

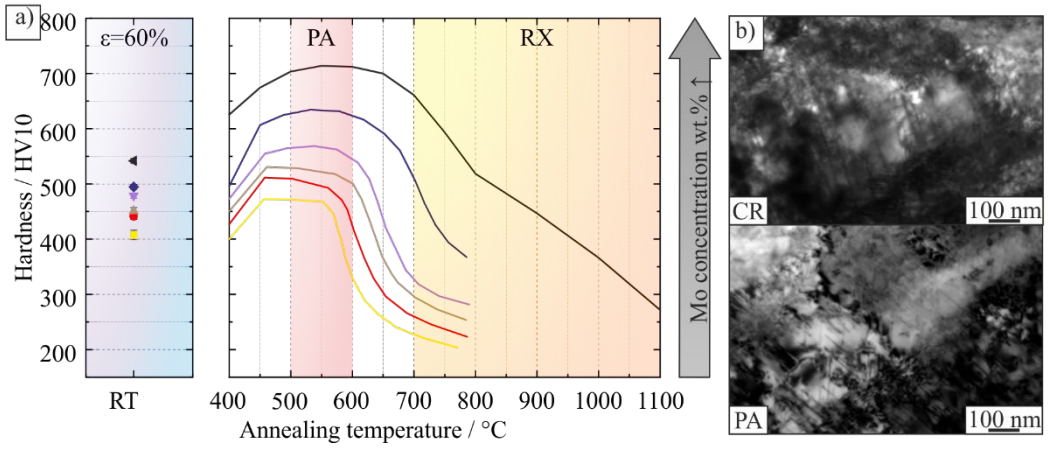

Fig.1: a) RT-Vickers hardness before and after annealing at different temperatures for 2 h of the different alloys with varying Mo-content, b) the corresponding STEM micrographs of the 10 wt.% Mo-containing alloy cold rolled (CR) and peak aged (PA).

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