Deep penetration capability and microstructure analyses in metals

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This paper proposes a new neutron diffraction configuration of residual stress measurements for cases that are over 80 mm thick. The reason for the deep penetration capability is attributed to the chosen wavelength having enough intensities due to the low cross-section near the Bragg edge and the reduced beam path length (~16 mm) reflected by the large diffraction angle. The configuration utilizes a neutron beam with a wavelength of 1.55 Å diffracted from the (220) plane with a diffraction angle (2θ) of 99.4◦. Neutron diffraction experiments with this configuration can decrease strain errors up to ±150 με, corresponding to a stress of about ±30 MPa. Second part of this talk about the microstructure analyses in additively manufactured (AM) alloys. The dislocation density is much higher than that of the conventional cast-wrought specimen due to the localized heating and rapid cooling in AM. Authors observed about 10 times higher initial dislocation density in AM (1.3 x 10^{14} m^{-2}) compared to the conventional cast-wrought specimen (0.18 x 10^{14} m^{-2}) in CoCrNi medium-entropy alloys. The stacking fault energy will be discussed for the explanation of the dislocation slip dominant deformation mechanism in AM rather than twinning.