Local texture and stress measurements on submicro-/nanocrystalline gradient materials

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Advanced multi-component, ultrafine grained (UFG) materials (mean grain size $d \leq 1\mu m$) have been produced by Severe Plastic Deformation (SPD). In general, this process leads to microstructural features and properties which are fundamentally different from those observed after conventional deformation [1]. The properties include high yield strength and/or ductility compared to coarse grained materials (Fig. 1). As can be seen, UFG (or nanocrystalline) metallic materials have a significantly higher ductility at high strength.

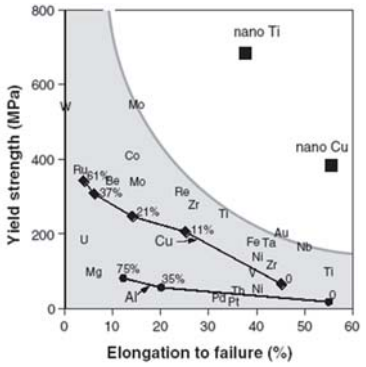

Fig.1: Cold rolling of Cu and Al increases the yield strength but decreases the elongation to failure (ductility) [1]

Thus, it is the aim of this work to study the correlation between texture, stress and the macro-mechanical properties in order to model the plastic anisotropy with regard to texture development. In particular, measurements of local gradients in texture and stress will be done on multilayered (laminated) materials produced by Accumulative Roll Bonding (ARB) (Fig. 2).

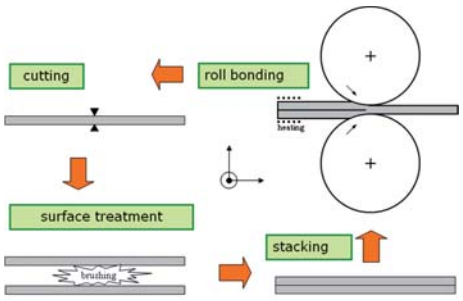

Fig. 2: Principle of Accumulative Roll Bonding

Because of their superior mechanical properties, ARB materials have a potential for advanced engineering applications [2, 3], for instance in automobile, aerospace, naval and medical industry.

References
[1] R.Z. Valiev et al., Nature Mater. 3, 511-515, 2004.
[2] I. Topic, PhD thesis, University Erlangen-Nürnberg, 2008.
[3] K. Kitazono et al., Scripta Mater. 50, 495 – 498, 2004.