

# Results in Progress

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## Deformation behaviour of ultrafine grained materials (UFG) materials

### Background

Ultra-fine grained (UFG) materials with grain sizes between  $100\text{nm} < d < 1\mu\text{m}$  and nanocrystalline (nc) materials with grain sizes less than  $100\text{nm}$  have been receiving significant attention due to their improved strength. However, their industrial application is limited by their low ductility. Therefore, tensile deformation behaviour and the mechanisms operating plastic deformation have been an object of many investigations as the ductility can be significantly improved via manipulation with the various deformation mechanisms. Compared to the monotonous deformation behaviour, the cyclic deformation behaviour of UFG and NC materials with respect to their deformation mechanisms has not been thoroughly investigated although their fatigue properties are important for their structural application, as well.

### Objective

In this work we are intended to investigate deformation behaviour of UFG materials produced by cold rolling of martensite and cryo-rolling of Al under monotonic and cyclic loading conditions with respect to their microstructural characteristics

### Method

Plain steel with starting microstructure of martensite (M) and tempered martensite (TM1: heat treated at  $200\text{C}$  for 1hr, TM2: heat treated at  $350\text{C}$  for 4 hrs) is cold rolled to a reduction of 50% (with cooperation of National Institute for Materials Science) followed by suitable heat treatment at  $550\text{C}$  for different times of 300s, 30min and 2hrs. Mechanical behaviour of the processed steel under monotonic loading will be studied considering their microstructural features. Cryo-rolling of 2024 Al alloy is carried out at liquid nitrogen temperature with total reduction of 75%. Following fatigue test will be conducted under constant plastic strain condition.

### Preliminary Results:

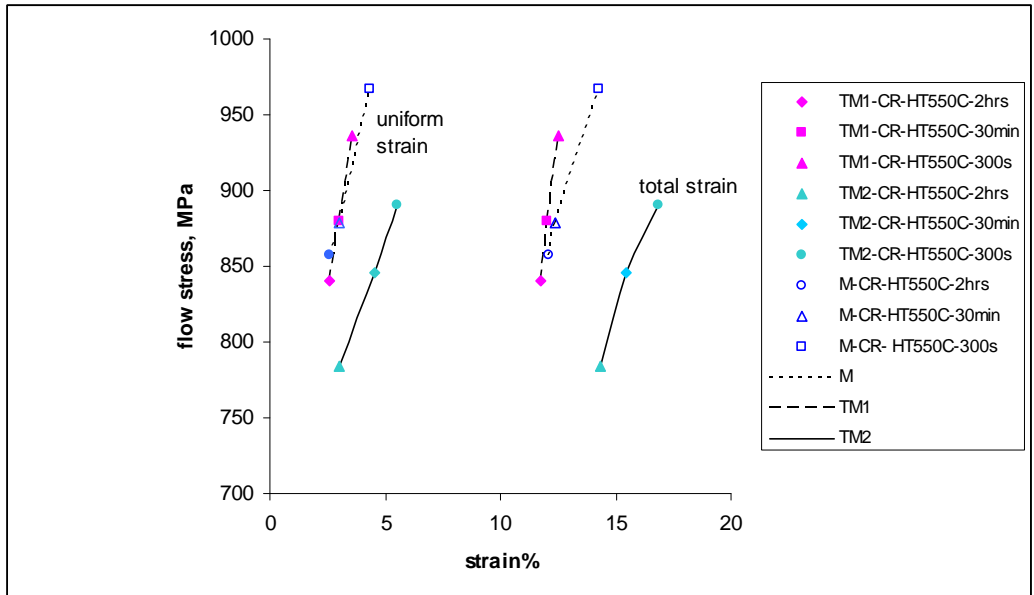


Fig.1: effect of different heat treatment conditions on mechanical properties of ultrafine grain carbon steel