The Deformation Behavior of Nanostructured Layered Metallic Composites and Superplastic Zn-Al alloys

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Nanostructured layered metallic composites with a layer thickness of only several nanometers can be produced nicely with accumulative roll bonding. Such composites have demonstrated very interesting properties in terms of strength and ductility and the strengthening mechanisms will be discussed in detail [1, 2]. Furthermore their thermal stability is exceptionally high due to the immiscibility of the individual layers in the e.g. Cu/Fe or Cu/Nb system. The deformation behavior of these nanolamellar composites will be compared with nanomechanical investigations of ultrafine-grained superplastic Zn-22Al alloys [3]. Nanostructured materials and composites typically show a strongly enhanced strain rate sensitivity due to the high density of interfaces [4]. This behaviour sometimes even leads to some kind of superplastic deformation or enhanced ductility. It is found that the superplastic flow behavior breaks down below a critical pillar diameter or plastic zone size although interface shearing is largely found on the pillar surfaces or close to the indents. This phenomenon is discussed based on the rate-controlling deformation processes involving dislocations which lead to this transition.

Keywords: nanostructured materials, superplastic deformation, nanomechanics, accumulative roll bonding, interfaces.

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