can be used to investigate material behaviour under high-temperature, high-strain rate thermomechanical processing, providing a technically feasible process for the generation of SPD materials in the shape of coatings.

351 Effect of friction stir processing on the damage resistance of 6xxx series aluminium alloys

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Damage evolution in ductile metals is characterized by the nucleation, growth and coalescence of small internal voids. In aluminium alloys, the void population generally nucleates by the decohesion or fracture of the iron rich intermetallic particles.
Previous studies have shown that the nucleation stress increases when the size of the intermetallic particles decreases retarding the final fracture of the material in tension. Furthermore, initial porosities and particle clustering reduce the final fracture strain as they favor earlier void coalescence by internal void necking.
Hence, friction stir processing (FSP) has been applied to a 6xxx series aluminium alloy in order to assess the ability of the process to eliminate initial porosity, fragment the intermetallic particles and distribute them more homogeneously to improve the fracture strain of the material. Detailed microstructural analysis of the intermetallics distribution has been carried out including 3D X-ray tomography and SEM micrographs. The mechanical properties have been investigated by tensile testing under various heat treatment conditions. In addition, a statistical study of void nucleation has been performed on 2D metallographic sections of interrupted tensile tests, as well as on 3D microtomography scan of fractured tensile samples.
This analysis confirmed that the size of intermetallic particles is reduced by FSP and that void nucleation is delayed. Furthermore, elimination of initial porosity and homogenization of the intermetallics distribution has been observed and quantified. Tensile tests have confirmed that these microstructural changes result in improved fracture strain.

352 Pre-hardened engineering and tool steel

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Pre-hardened engineering and tool steel. Per Hansson, Magnus Andersson. SSAB Special Steels. During the last decades has a rapid development in hard-machining taken place which enable steel manufacturers to develop a range modern pre-hardened engineering & tool steels which have leaner chemical compositions when compared with conventional steel grades commonly used in comparable applications such as moulds/dies. Use of pre-hardened grades enables faster, and also cheaper, component/tool manufacturing thanks to the elimination of heat treatment (Q&T) during component/tool manufacturing. Furthermore, the possible elimination of heat treatment during component/tool manufacturing also means less impact on environment due to elimination of transport to/from the heat treatment shop. Today's modern pre-hardened engineering & tool steels are delivered at nominal hardness ranging from 300 HBW up to 450 HBW (45 HRC) i.e. having Approx. yield strength ranging from 850 to 1300 MPa. The design of such pre-hardened steels, chemical compositions and processing routes, give steel having excellent machining properties combined with very high dimensional