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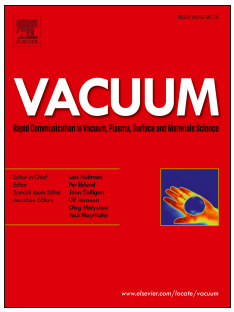

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Hot deformation behaviors of a solution-treated Ni-based superalloy under constant and changed strain rates

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ASTRACT

Hot deformation behaviors of a solution-treated Ni-based superalloy are investigated. There are two types of hot compressive tests. Type A means that the strain rate keeps constant, while Type B denotes that the strain rate firstly keeps a high value in stage I, then a low one in stage II. It can be found that the deformation parameters and deformation history have great effects on the flow behavior. There is a sudden change in the true stress of type B when the strain rate is suddenly decreased. Comparing to the flow stress curve of types A and B , it is found that the stress of type B is slightly higher. However, the difference in the true stress between type A-II and type B gradually decreases and eventually disappears. The microstructural evolution is also significantly influenced by deformation parameters. Firstly, it is beneficial to increase deformation temperature or decrease strain rate for dynamic recrystallization (DRX). Secondly, both the average DRX grain size and misorientation angle are positively correlated with deformation temperature while negatively correlated with strain rate. Besides, the average DRX grain size of type B is between that of types A-I and A-II, so do the fraction of DRX .

Keywords: Hot deformation; Superalloy; changed strain rates; Dynamic recrystallization

1 Introduction

Generally, there is a complex deformation for metals and alloys during forging [1]. There are three main mechanisms in hot deformation [2,3,4], i.e., work hardening (WH), dynamic recovery (DRV) and dynamic recrystallization (DRX) [5,6,7]. DRX plays a most major role in microstructural evolution and is an important mechanism to refine grains [8,9,10]. Thus, the study on hot deformation behavior is necessary and important to obtain the optimum processing parameters [11,12,13].

In recent years, many studies on the thermal deformation behavior have been done. For instance, the microstructural evolution of ultrafine grained zircaloy-4 [14], Ti-2Al-9.2Mo-2Fe alloy [15], Nb-bearing high-Mn steel [16], nimonic 80A [17], vanadium microalloyed TRIP-assisted steel [18], 25Cr3Mo3NiNb steel[19], Al-Li 2198-T8 alloy [20], K465 superalloy [21],typical Ni-based superalloy [22], high-energy mechanical treatment of ZnO and black NiO power mixture [23], 42CrMo steel[24], 26NiCrMoV steel [25], plain carbon steel [26], AZ31B magnesium alloys

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