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ACCEPTED MANUSCRIPT

Achieving fine-grained equiaxed alpha via thermo-mechanical loading under off-equilibrium state in two-phase Ti-alloys

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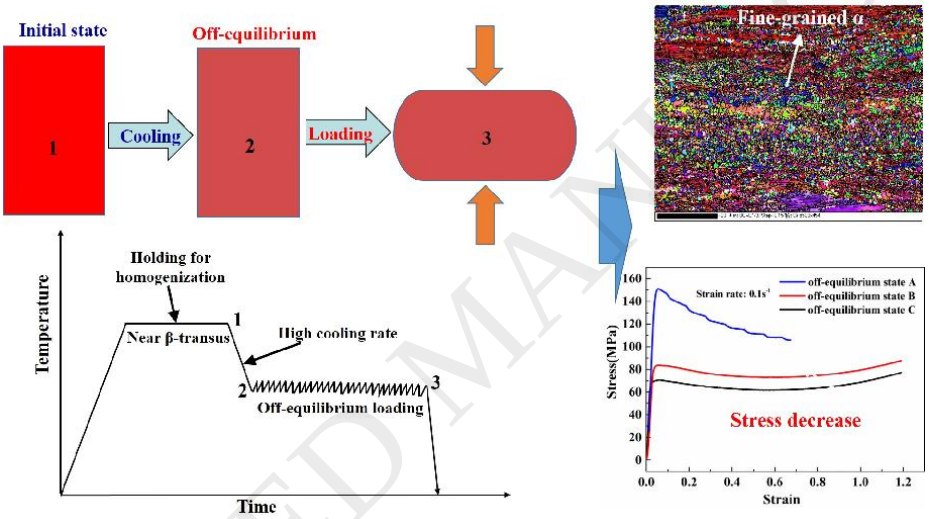
Graphical Abstract



Abstract: An off-equilibrium hot deformation scheme was proposed to achieve fine-grained equiaxed alpha (α_s) for two-phase titanium alloys. Controlled cooling and deformation was carried out at the soaking temperatures of 950-990℃,cooling rates of 50-140℃/min and strain rates of 0.01-0.1s^{-1} in TA15 alloy. The results showed that fully fine-grained equiaxed α_s (~500nm) was obtained after heating to near β-transus temperature, fast cooling (i.e., >140℃/min) and subsequent hot deformation at strain rates above 0.1s^{-1}. The transformation of nucleation mode from complete wetting to incomplete wetting promoted by hot deformation mainly resulted in the formation of fine equiaxed α_s at the β/β grain boundaries. For intragranular α_s phase, selective heterogeneous nucleation at dislocations with reduced nucleation barrier and weak variant selection mainly led to the formation of equiaxed α precipitates. A comparison among different off-equilibrium cases revealed that flow stress was decreased greatly by

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