

Supplementary Material

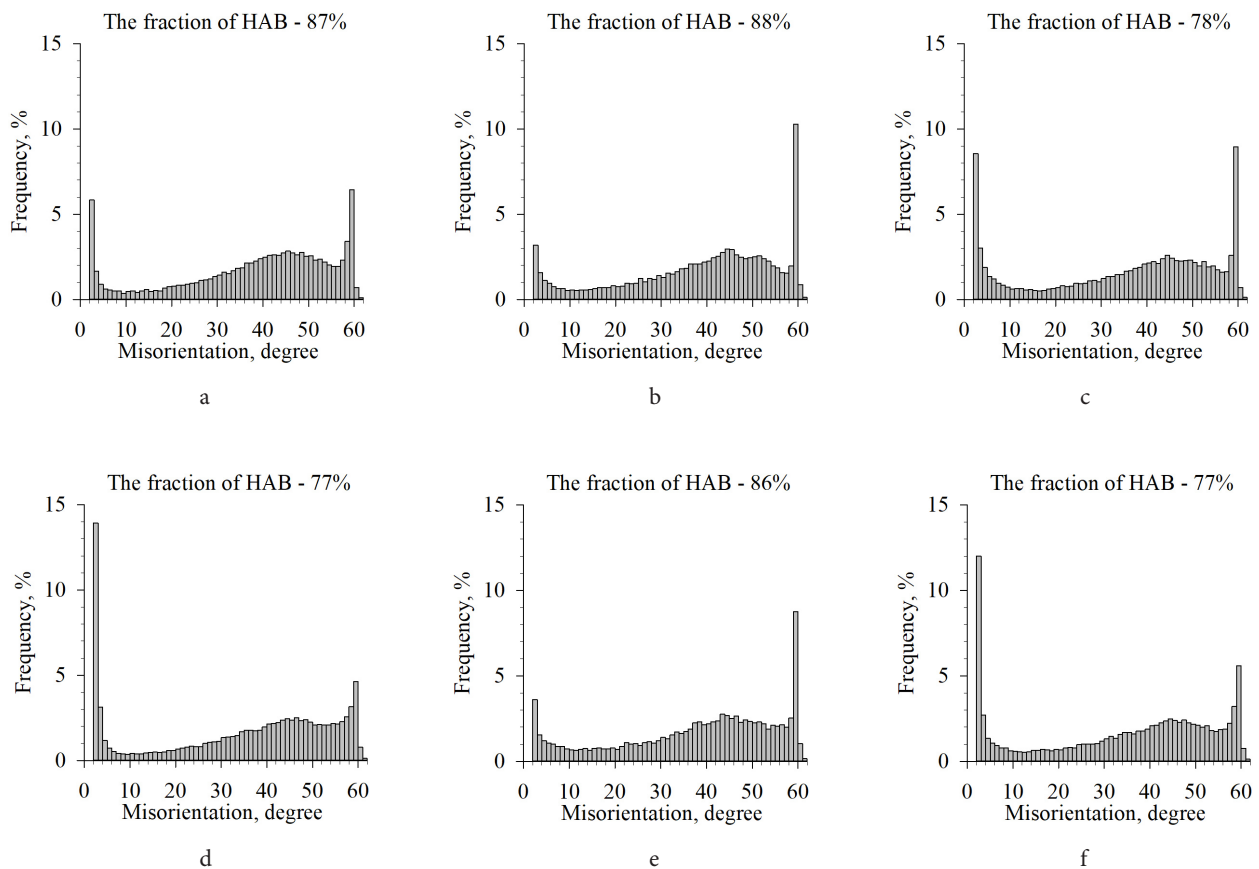


Fig. S1. Misorientation-angle distributions for grain/interphase boundaries corresponding to the EBSD maps shown in Fig. 4: $T=1125^{\circ}\text{C}$, $\dot{\epsilon}=10^{-2}$, 5×10^{-3} and $5 \times 10^{-4} \text{ s}^{-1}$ (a–c, respectively), $T=1150^{\circ}\text{C}$, $\dot{\epsilon}=10^{-2}$, 5×10^{-3} and $5 \times 10^{-4} \text{ s}^{-1}$ (d–f, respectively). HAB designates high-angle grain/interphase boundaries.

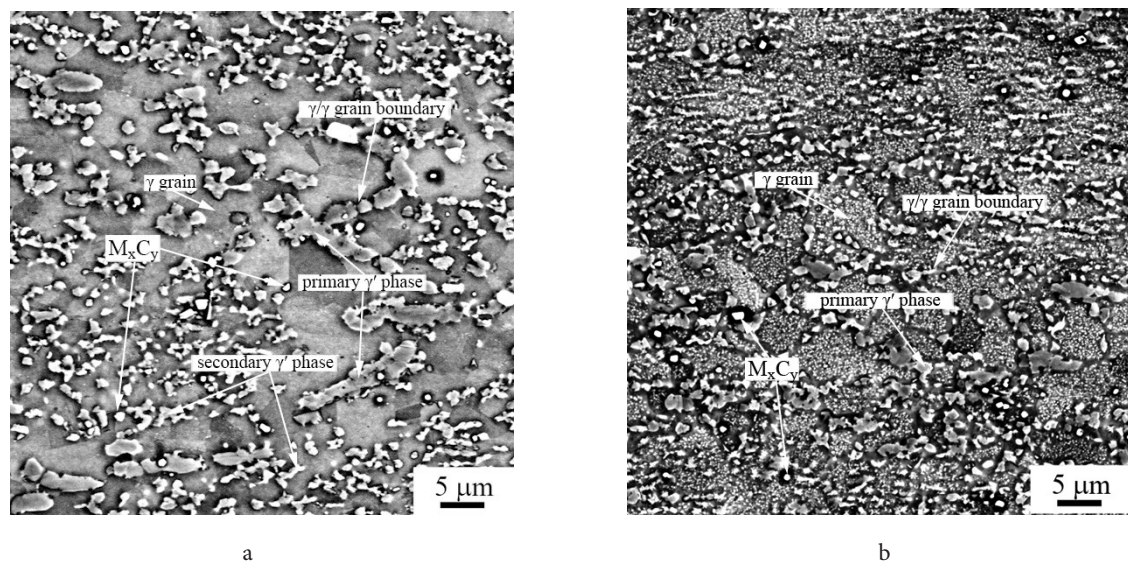


Fig. S2. BSE images obtained from the central parts of samples of the VV751P superalloy subjected to preliminary annealing and hot compression to a strain of $\epsilon \approx 75\%$: $T=1125^{\circ}\text{C}$, $\dot{\epsilon}=10^{-2} \text{ s}^{-1}$ (a), $T=1150^{\circ}\text{C}$, $\dot{\epsilon}=10^{-2} \text{ s}^{-1}$ (b).

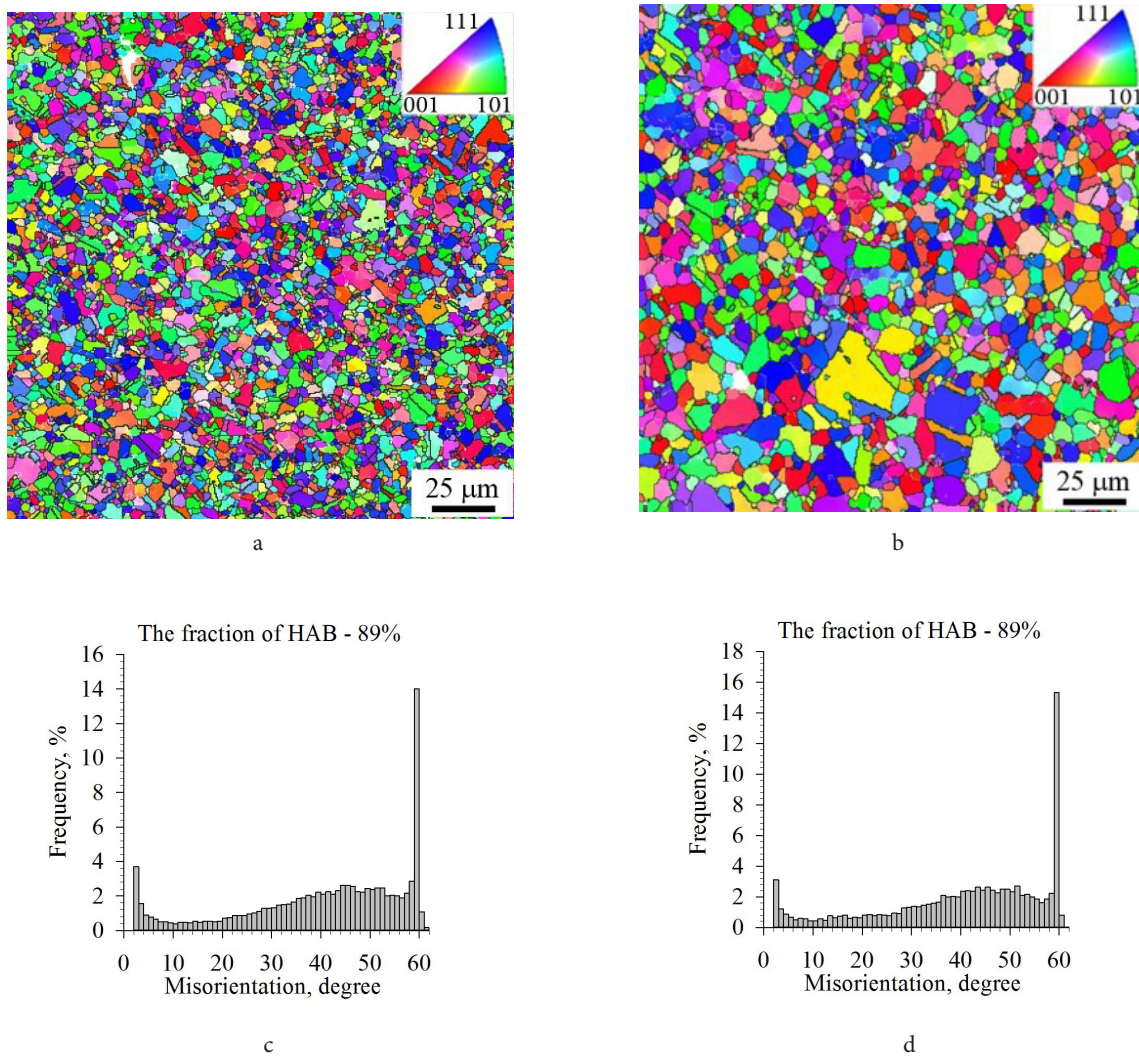


Fig. S3. (Color online) Normal-direction EBSD maps (inverse-pole-figures) (a, b) and corresponding misorientation-angle distributions for grain/interphase boundaries (c, d) obtained from central parts of samples of the VV751P superalloy subjected to homogenization, hot compression and subsequent recrystallization annealing: $T=1125^{\circ}\text{C}$, $\dot{\epsilon}=10^{-2}\text{ s}^{-1}$ ($\epsilon\approx 75\%$) and annealing at 1100°C (a, c); $T=1150^{\circ}\text{C}$, $\dot{\epsilon}=10^{-2}\text{ s}^{-1}$ ($\epsilon\approx 75\%$) and annealing at 1125°C (b, d). The forging axis is vertical, high- and low-angle grain/interphase boundaries are indicated by black and white lines, respectively.

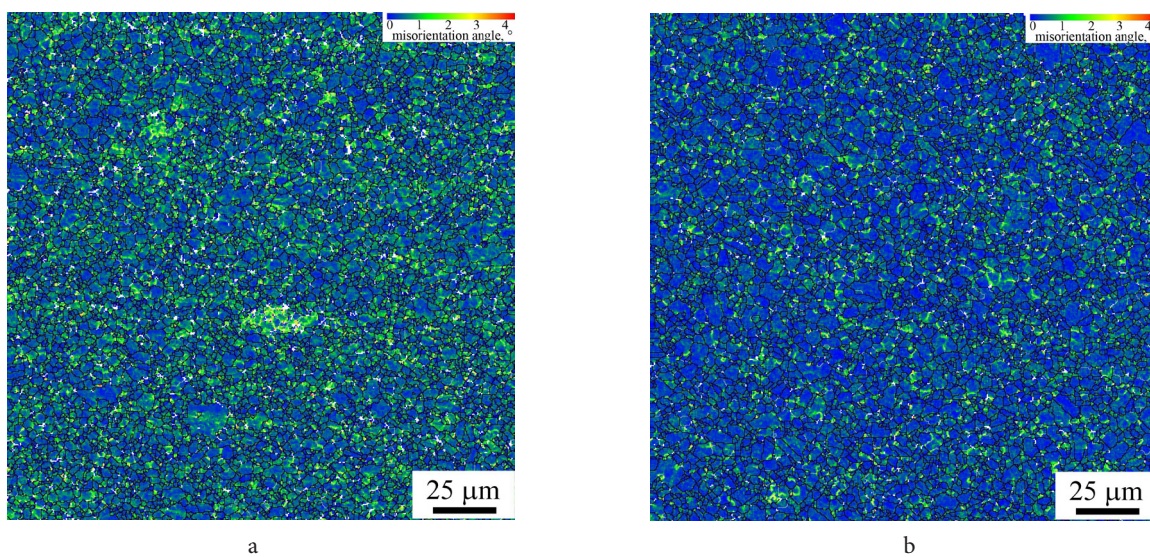


Fig. S4. (Color online) KAM maps corresponding to Fig. 4a (a) and S3a (b): $T=1125^{\circ}\text{C}$, $\dot{\epsilon}=10^{-2}\text{ s}^{-1}$ ($\epsilon\approx 75\%$) (a), $T=1125^{\circ}\text{C}$, $\dot{\epsilon}=10^{-2}\text{ s}^{-1}$ ($\epsilon\approx 75\%$) and annealing at 1100°C (b). The green color shows not completely recrystallized areas with a higher dislocation density.

Table S1. The average sizes of γ grains/primary γ' phase and the fraction of high-angle grain/interphase boundaries (HAB) depending on the processing conditions.

Processing route ¹	$\dot{\epsilon}$, s ⁻¹	The average size of γ grains/primary γ' phase, μm		The fraction of HAB, %	
		without A ²	after A	without A	after A
HIP + H + C(1125°C)	10 ⁻²	2.1	2.5	87	89
HIP + H + C(1150°C)	10 ⁻²	2.5	3.6	77	89
HIP + H + C(1125°C)	5 × 10 ⁻³	2.6	2.9	88	83
HIP + H + C(1150°C)	5 × 10 ⁻³	3.3	3.7	86	85
HIP + H + C(1125°C)	5 × 10 ⁻⁴	2.7	2.9	78	82
HIP + H + C(1150°C)	5 × 10 ⁻⁴	3.5	3.9	77	77

¹ HIP — hot isostatic pressing, H — homogenization annealing, C — hot compression

² A — post-deformation annealing