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# In situ EBSD Studies of Blocky Grain Growth in Welded Zircaloy-4

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Zircaloy-4 is used extensively in the nuclear industry. It has an allotropic phase change from hexagonal close packed (HCP) alpha phase at room temperature to body centred cubic (BCC) beta phase at high temperature. This phase transformation results in a 'memory' of the microstructure when it is subject to thermomechanical processing and introduces special interfaces via the Burgers orientation relationship.

In this work, we explore these transformations in a welded microstructure subject to a post weld heat treatment, to explore how very large so-called 'blocky-alpha' grains [1] can form and grow. These blocky-alpha grains can be problematic for the performance of a component made from zircaloy-4.

We use *in situ* fore scatter imaging and EBSD, combined with previously developed parent grain reconstruction code [2], to understand the formation of blocky-alpha grains and what pins their growth.

In figure 1, we observe the growth of blocky-alpha graphs from the edge of prior beta-grains into neighboring prior beta grains. Through analysis using our parent grain reconstruction code, we analyze the orientation of grains involved in this mechanism and combine these studies with an understanding of variant selection in the parent beta grain domains.

Our observations enable us to understand the mechanisms of blocky-alpha grain through and enhance understanding of thermomechanical processing of materials used in demanding environments [3].

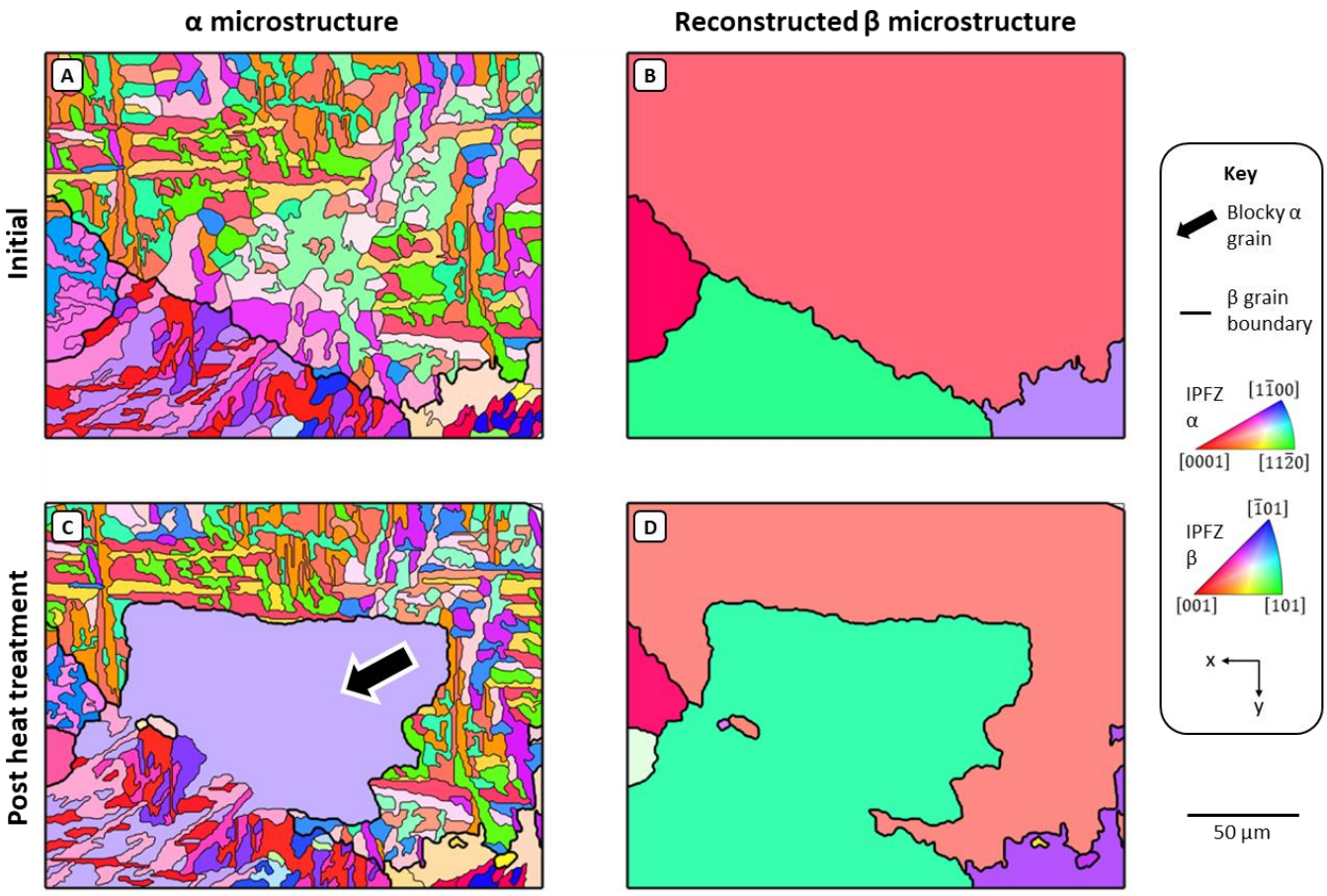


**Figure 1.** Example showing the on-set of blocky growth in zircaloy-4. TOP: (A) Initial alpha-phase microstructure and equivalent (B) reconstructed parent beta microstructure. BOTTOM: (C) alpha-phase microstructure and equivalent (D) reconstructed parent beta microstructure post heat treatment (3 x 10mins at 800°C). The growing blocky grain is indicated by the arrow on (C). All maps are IPFZ.

References:

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