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Growth behavior of rounded (Ti,W)C and faceted WC grains in a Co matrix during liquid phase sintering

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Growth behavior of two different types of grains, faceted and rounded, in the same liquid matrix has been studied in the 70(25TiC-75WC)-30Co (wt%) system. Powder samples were sintered above the eutectic temperature for various times under a carbon saturated condition. (Ti,W)C grains with a rounded shape and WC grains with a faceted shape coexisted in the same Co-based liquid. With increasing sintering time the average size of (Ti,W)C grains increased continuously and very large WC grains appeared. The growth of rounded (Ti,W)C grains followed a cubic law indicating diffusion-controlled growth. On the other hand, the growth of the faceted WC grains resulted in a bimodal grain size distribution, showing abnormal grain growth. With increased initial size, however, abnormal growth of WC grains was suppressed. This growth behavior of WC grains could be explained using growth theories of faceted crystals and was also confirmed by a calculation using their growth equations. The present investigation thus shows that the growth behavior of one type of grain is not affected by the other type of grain in the same matrix and is governed only by whether the grain shape is faceted or rounded.