[A8]

Change in the microstructure near the surface by the introduction of nitrogen during sintering in $Ti(C_{0.5}N_{0.5})$-20WC-10Ni-10Co cermets.

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Cermets and cemented carbides are materials consisting of hard carbide or carbonitride grains embedded in more ductile phases, such as nickel or cobalt. Nowadays the addition of nitrogen to these systems is indispensible for enhancing properties. It is known, however, that loss of nitrogen from nitrogen-containing phase during processing results in changes in composition, porosity, and sometimes gives rise to a microstructurally inhomogeneous surface layer, so-called surface gradient zone.

Experiments were carried out in order to elucidate the influence of the introduction of nitrogen during sintering on the formation of the surface gradient zone. WC was used as a secondary carbide to a Ti(CN)-Ni/Co system, and were processed in vacuum, and various nitrogen conditions(at 10 Torr). The nitrogen gas was introduced during heating(1300℃~1450℃), holding(1450℃/1hr), cooling(1450℃~1300℃), and all stage (above 1300℃), respectively. The interrupted sinterings for each condition were also performed to examine the onset of material transfer between surface and interior via liquid melt.

It was found that the introduction of nitrogen during heating stage facilitated solid-solution band formation more than vacuum condition. From thermodynamic calculation, it was revealed that the denitrification at 1450℃ is more vivid than at 1300℃. The nitrogen atmosphere during heating stage is supposed to maintain the microstructure without or with retarding the dissolution and reprecipitation of hard phase especially WC to higher temperature. It was also found that the introduction of nitrogen during holding or cooling stage enriched binder phase near the surface and the thickness of stratified binder layer was related to the cooling rate.

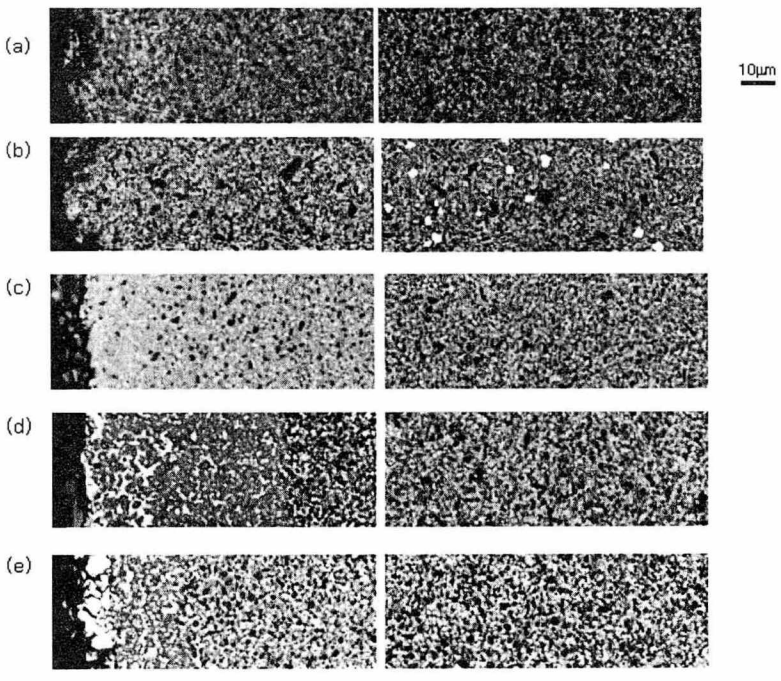

Fig. 1 The microstructures of $Ti(C_{0.5}N_{0.5})$-20WC-10Ni-10Co sintered at 1450°C for 1hr in (a) vacuum, (b) N_2 at 1torr during all stage, (c) N_2 at 1torr during heating stage, (d) N_2 at 1torr during holding stage, (e) N_2 at 1torr during cooling stage.