Ceramic Shell Process for Reactive Ti Alloys

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ABSTRACT

Investment casting of titanium alloys is increasingly used in aeronautical and medical applications. Titanium is very reactive in the molten state. Coating the pattern with the usual ceramic slurries based on silica and aluminosilicates produces a reaction with the Ti alloys. This reaction develops intermetallic compounds that significantly reduce the mechanical properties of the casted parts. To overcome this problem, titanium alloys should be poured into special ceramic shells that avoid or significantly reduces this reaction. Ceramics, such as CaO, ZrO_2, Y_2O_3 and ThO_2 have been adopted for mold materials.

In order to test the reactivity of different ceramic materials with Ti and its alloys, ceramic shells were manufactured over wax models. The composition of ceramic slurry is given n Table 1. The cast alloy is TiAl6V4.

Table 1: Composition of ceramic slurry

Filler	Binder
Yttria stabilized Zirconia (ZrO_2 – 6% wt Y_2O_3)	Colloidal Silica
Calcia stabilized Zirconia (ZrO_2 – 3% wt CaO)	Colloidal Silica
Yttria (Y_2O_3)	Colloidal Silica

The microhardness profiles of the samples casted in ZrO_2-Y_2O_3 and ZrO_2-CaO ceramic shells are similar. The depth of the alpha-case is around 0.52 mm for ZrO_2-CaO ceramic shell and 0.43 mm for ZrO_2-Y_2O_3. Y_2O_3 ceramic shell almost does not produce alpha-case.

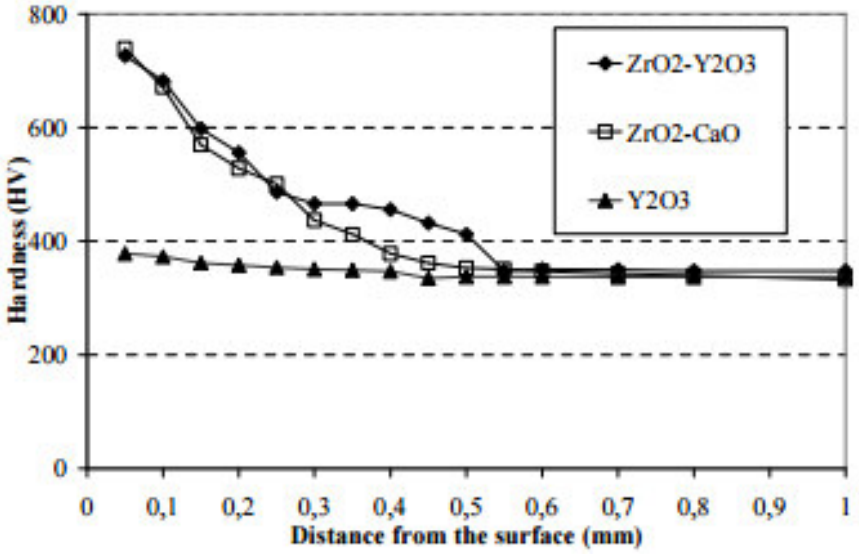

Figure 1: Microhardness profiles as a function of the distance from the shell-metal interface.

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