PREPARATION, OXIDATION AND ABLATION RESISTANCE OF IRAL INTERMETALLIC COATING

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Iridium (Ir) has been selected as the protective coating on the rhenium thruster chamber of the liquid rocket engine, due to its high melting point, excellent corrosion resistance and quite low oxygen permeability. However, Ir forms gaseous oxides rather than a protective oxide barrier above 1100°C under oxidizing environments, leading to a limited lifetime at high temperatures. To improve the oxidation resistance, in the present work pure Ir was modified by pack cementation to produce a single phase IrAl intermetallic coating. The bond strength of the coating was examined by coating-pull-off test. The oxidation and ablation resistance was assessed by cyclic oxidation test at 1800°C and high frequency plasma wind tunnel test (heat flux: 2.03MW/m^2 and enthalpy: 19MJ/kg), respectively. It was found that the IrAl coating is well boned to the substrate with a bond strength above 30MPa. The oxidation and ablation resistance of the Ir was significantly enhanced after the pack cementation treatment (see *Figure 1*). The improvement in oxidation and ablation resistance can be ascribed to the excellent comprehensive properties of the in-situ formed Al_2O_3 barrier and outstanding physical and chemical compatibility among the phases in the multilayer coating system.

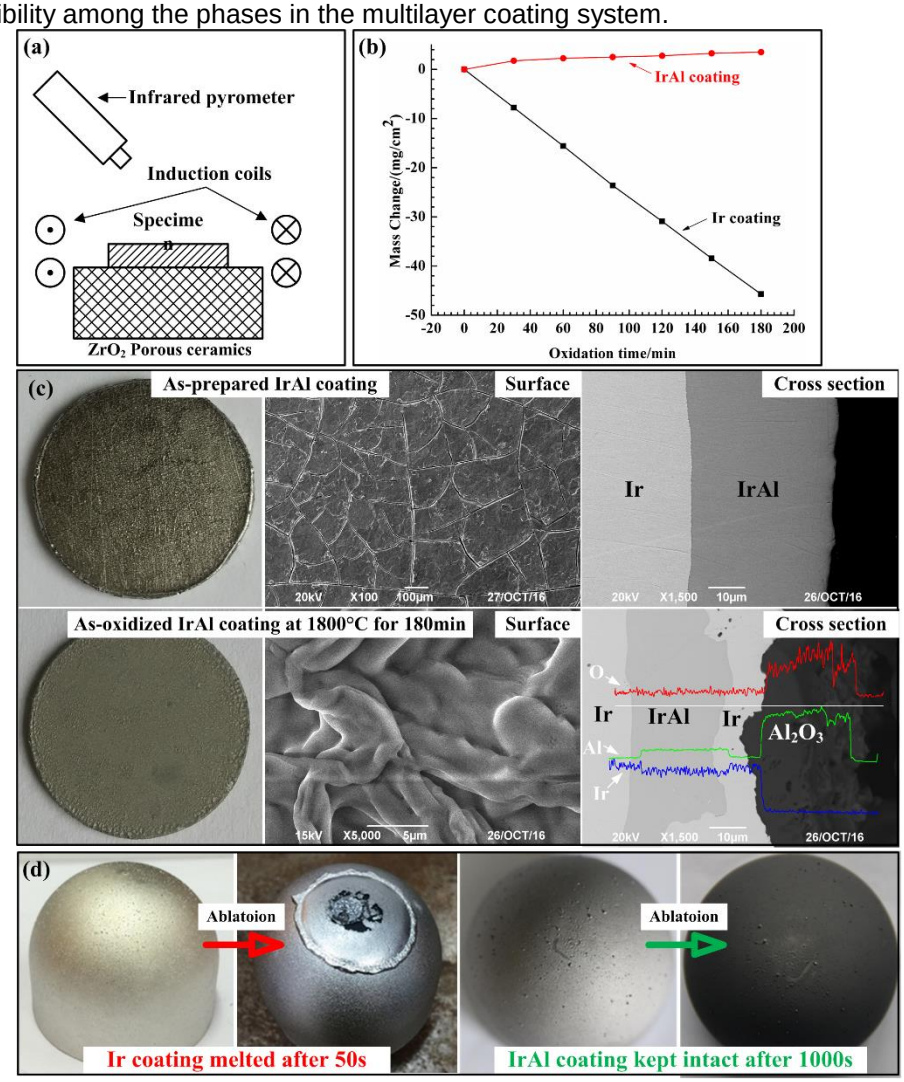

Figure 1 – Oxidation and ablation behaviors of the IrAl coating: (a)set-up for oxidation test, (b)mass change versus time, (c)morphology evolution after oxidation and (d) morphology evolution after ablation