Characterization of oxidation-resistant coatings produced by kinetic metallization technique

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Specimens

Substrate : Inconel 601

Oxidation-resistant coating: Co-32Ni-22Cr-8Al0.5Y

Thicknesses:

1) approx. 80μm
2) approx. 200 μm
3) approx. 500 μm

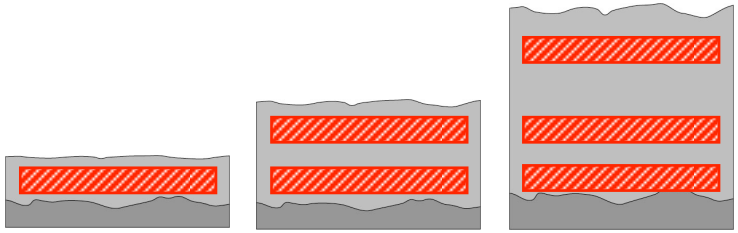
Specimens geometry: 10mmX10mm

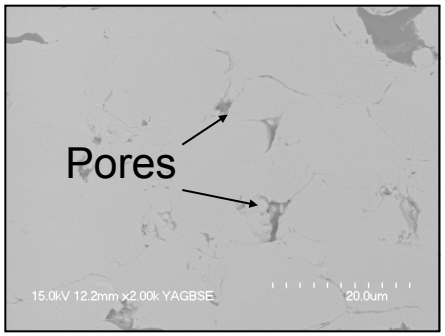
Experimental procedures

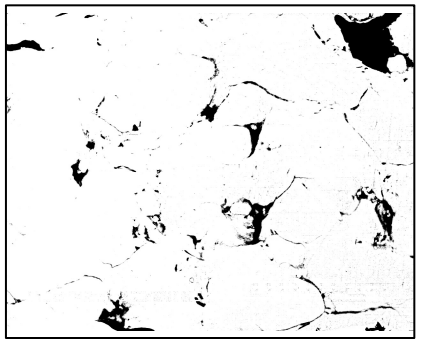
(1) Porosity measurements

From more than 10 views of SEM images, porosity ratio was obtained.

$$\text{Porosity ratio} = \frac{\text{Sum of pores area}}{\text{Area of SEM image}}$$

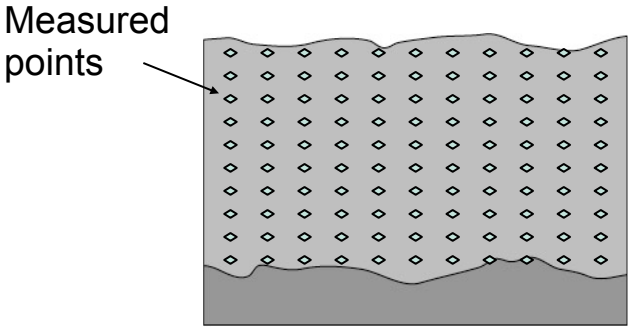






(2) Hardness measurements

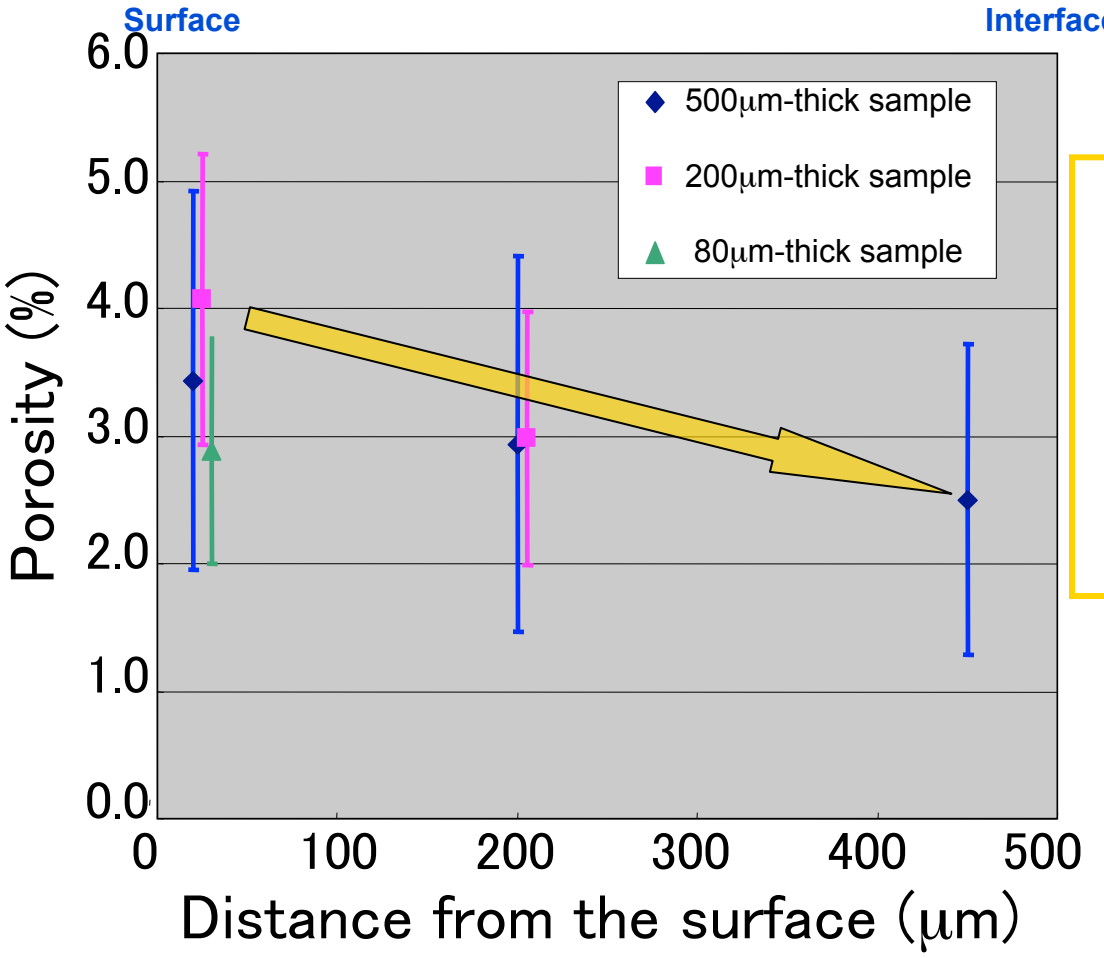
- As shown in right figure, Vickers hardness was measured.
- And calculate average and standard deviation



(3) High temperature exposure tests

After high temperature exposure tests at 1000°C for 5, 50, and 500 hours, thermally grown oxides were measured by SEM.

Porosity ratio

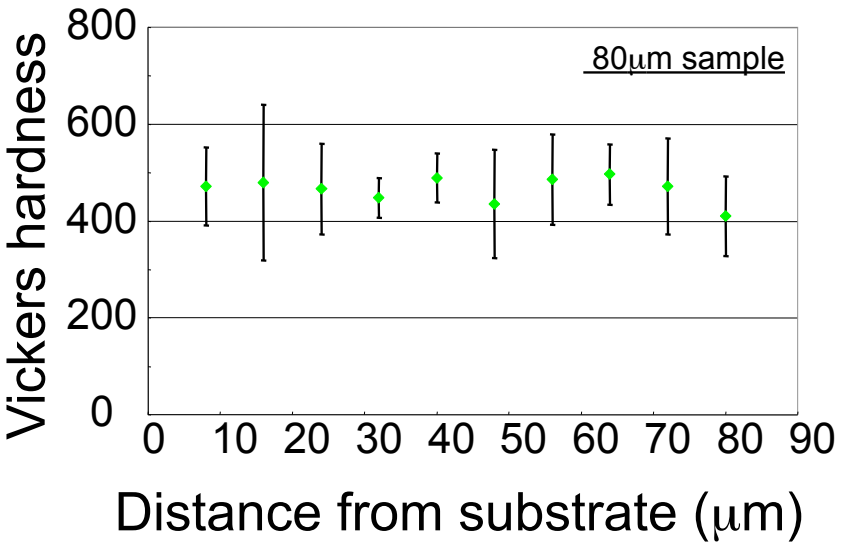


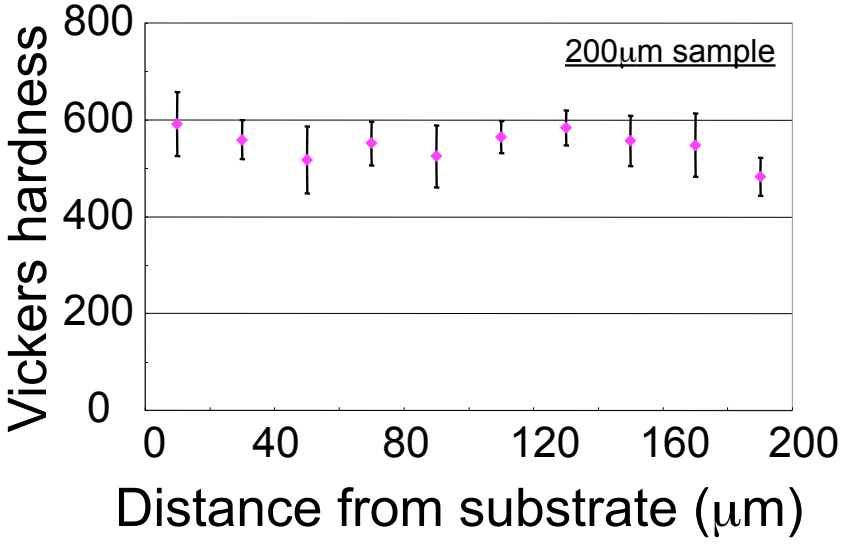
Porosity ratio of plasma sprayed coatings
Approx. 10~20 %

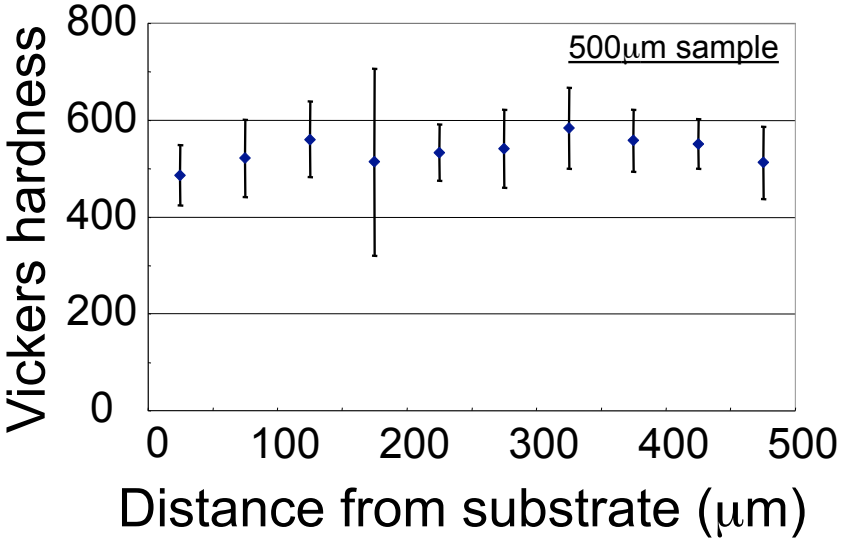
The KM sprayed coatings have lower porosity ratio than the plasma sprayed ones.

The porosity ratio at the interface was denser than that at the surface.

Vickers hardness



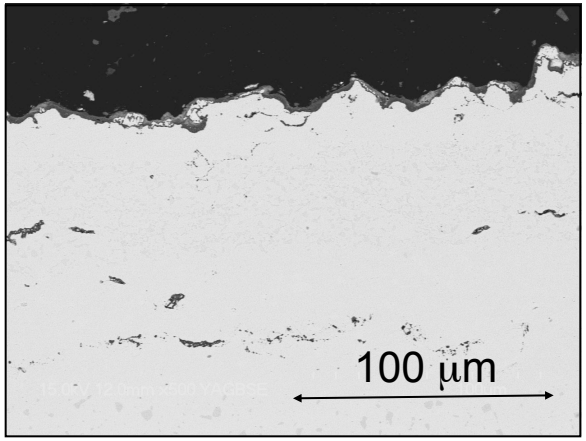




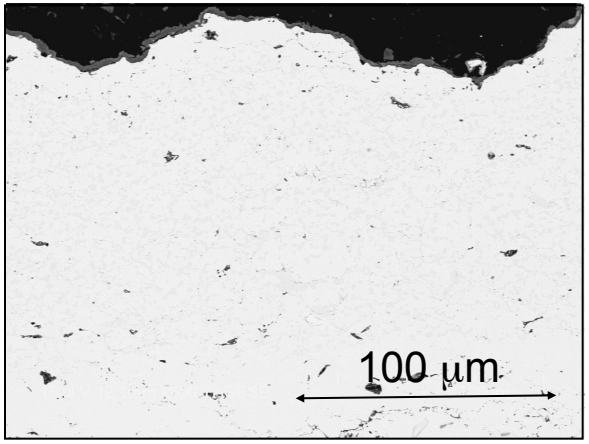
From these figures, there are hardness distribution in the thickness direction.

Hi-temp. exposure tests-1

1000°C - 50 hours



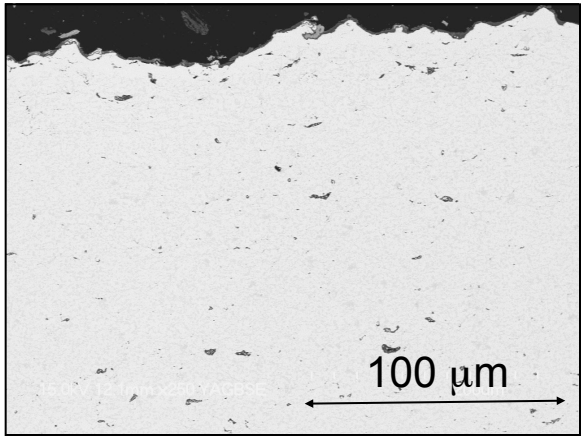
KM sprayed (80μm)



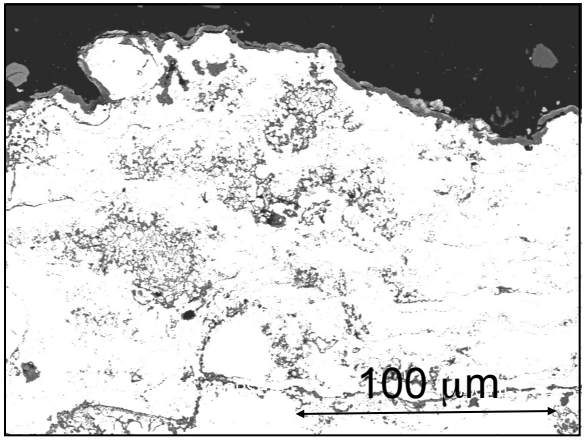
KM sprayed (200μm)

The KM sprayed coatings

Almost no oxide inside the coating



KM sprayed (500μm)

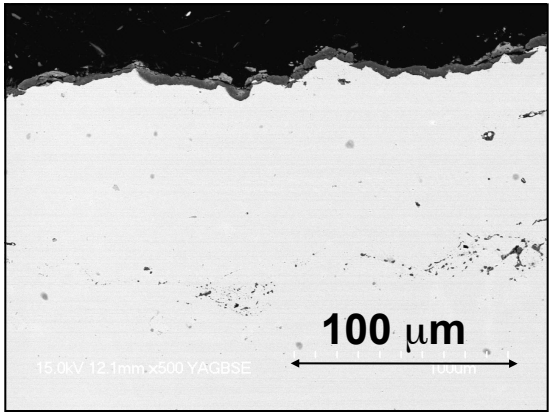


Plasma sprayed

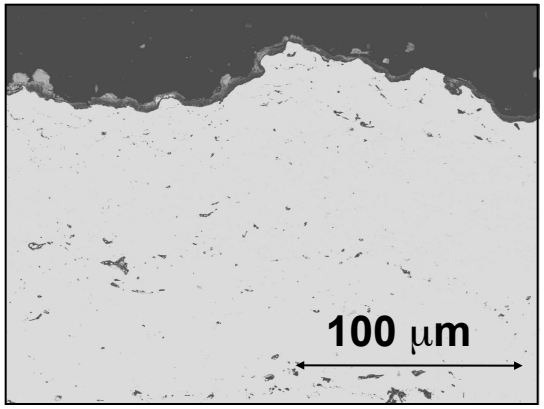
The oxide thickness of the plasma sprayed coating is thicker than the KM sprayed ones.

Hi-temp. exposure tests-2

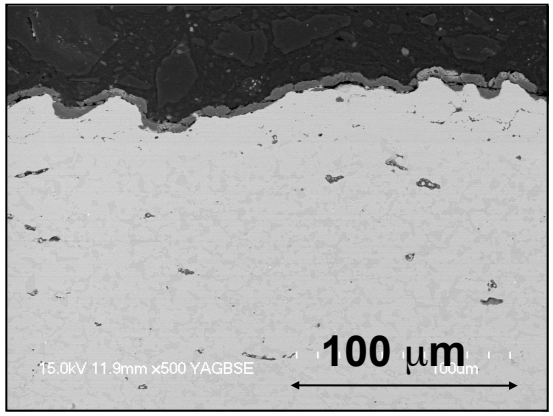
1000°C - 500 hours



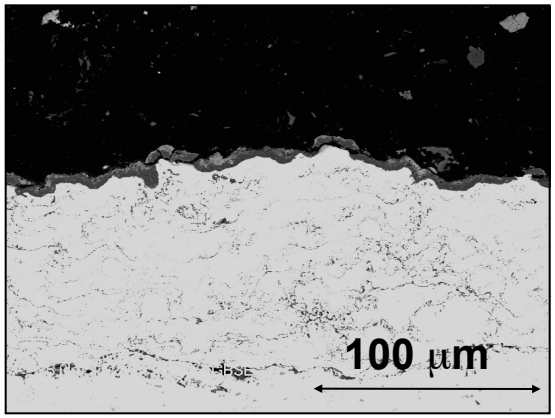
KM sprayed (80μm)



KM sprayed (200μm)



KM sprayed (500μm)



Plasma sprayed

The relationship between oxide thickness and exposed time