TOYOHASHI UNIVERSITY OF TECHNOLOGY
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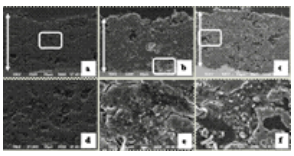
Research highlights

Aluminum nitride coatings by atmospheric reactive plasma spray



SEM cross section images of the AlN coatings fabricated with using N_2 plasma gas flow rate of: (a) 100, (b) 120, (c) 160 l/min and (d-f) are higher magnifications of the squared parts in (a-c).

Aluminum nitride (AlN) has a high thermal conductivity, low thermal expansion (similar to silicon) and exhibits high resistance to halogen plasma. These remarkable properties of AlN are exploited in heat sinks and semiconductor manufacturing equipment, such as chemical vapor deposition reaction vessels and electrical components.

For such applications fabrication of thick AlN coating by thermal spray into the chosen material surface considered to be suitable solution. However, it is impossible to fabricate AlN coating directly by conventional thermal spraying due to the AlN thermal decomposition without melting.

Here, Mohammed Shahien and colleagues at Toyohashi University of Technology, Japan report on the realization of cubic AlN coatings on steel substrates by atmospheric reactive plasma spraying of fine Al_2O_3 feedstock powder in N_2/H_2 plasma.

The formation process was clarified thus, during spray the particles melted, spheroidized and nitrided in the plasma to form the cubic aluminum oxynitride then cubic-AlN. Furthermore, using smaller particle size enhanced the surface (reaction) area and improved the nitriding conversion.

It was possible to fabricate thick and uniform coatings with high AlN content by spraying fine Al_2O_3/AlN mixture and the thickness increased from about 150 µm to about 200 µm with increasing the N_2 gas flow rate from 100 to 160 l/min.

These results are important for the manufacture of high performance equipment for the materials manufacturing including semiconductors.

Mohammed Shahien

Reference

Authors: M. Shahien, M. Yamada, T. Yasui, M. Fukumoto
Title of paper: Aluminum Nitride Coating Fabricated by Reactive Plasma Spraying of Al2O3
Journal: Proceedings of Thermal Spray 2012: Proceedings from the International Thermal Spray Conference and Exposition.May 21–24, 2012, Houston, Texas, USA. Pages: 873-879.
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