

Study of a Photoacoustic Measurement Technique for Thermal Diffusivity and Thermal Effusivity of Ceramic Coatings

Atsumasa Yoshida^{C, S}, Yoshiki Nagao, Tetsuya Yamada, Kakeru Kagata and Shinichi Kinishita
Department of Mechanical Engineering, Osaka Prefecture University, Sakai, Osaka, Japan
ayoshida@me.osakafu-u.ac.jp

Thermal properties are used for evaluation of thermal performance, such as thermal resistance and thermal insulation. Thermal resistance of ceramics is superior to any other material. Thermal spraying is one of the methods to add thermal resistance to objects. To measure thermal properties of thermally sprayed objects, it is necessary to measure without processing them. If they are valuable objects, nondestructive measurement is more desirable. The goal of this study is to more accurately measure thermal diffusivity and thermal effusivity of light scattering materials like ceramics using a photoacoustic method. A photoacoustic technical approach was developed to measure the thermal diffusivity and thermal effusivity of ceramics that have been surface coated using a thermal spraying method. It was shown that for coated ceramics in which absorption was dominant, it was possible to measure the thermal diffusivity and thermal effusivity simultaneously by taking the thermal diffusion length into consideration, using a method that permitted direct laser light incident on a sample. For coated ceramics with high reflection and scattering, we used a method in which a sheet metal was placed on a sample and laser light was irradiated on the sheet metal. By considering the thermal diffusion length, the thermal effusivity could be obtained, and the thermal diffusivity could then be calculated using the known thermal effusivity.