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Optical Spectroscopic Measurement during CFRP Irradiation and its Surface Observation

CFRP材へのプラズマ照射時の分光計測と表面状態の変化

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Simple and efficient repairing technology for damaged CFRP (carbon-fiber-reinforced plastic) is desired in several fields such as the aircraft industry. In this study, we have attempted to use atmospheric pressure plasma for repairing a CFRP plate. The CFRP plate is irradiated by atmospheric pressure plasma directly. SEM observations of the plasma-irradiated CFRP for the limited conditions have been done. So far, we have observed removals of plastic components from the CFRP by plasma irradiation. These results suggest us that the possibility of repairing CFRP using plasma.

1. Introduction

Recently, Carbon fiber reinforced plastic (CFRP) attracts attention from various fields such as the aircraft industry. CFRP is well known to be strong and light weight material. However once a CFRP component is damaged, the part needs to be replaced with new one. Hence the way of repairing damaged CFRP is desired. In this study, we attempt to use our atmospheric pressure plasma for CFRP repairing. During the atmospheric pressure plasma irradiation to the CFRP sample, optical spectroscopic measurement has been done. The change of surface condition of the sample after irradiation has been also observed by using SEM.

2. Irradiation of Atmospheric Pressure Plasma on CFRP

Samples of CFRP were irradiated with atmospheric pressure microwave plasma generated by microwave of 2.45GHz. The sample size is 30mm ×25mm×1.5mm, The sample was formed by 14 carbon fiber layers.

The irradiation experiments conducted by changing gas flow rate, gas species and discharge power.

As shown in Figure 1, SEM images clearly indicate that removals of plastic components from CFRP by plasma irradiation. These results suggest us that the possibility of repairing CFRP using plasma. Figure 2 shows the emission spectrum during plasma irradiation on CFRP. A line emission around 388nm is appeared during CFRP irradiation. The origin seems to be plastic components of CFRP.

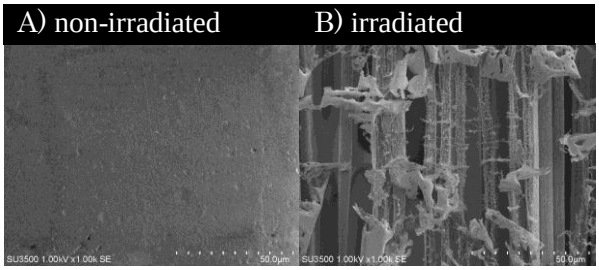

Fig 1. SEM image of the surface of the CFRP sample A)non-irradiated, B)irradiated region by atmospheric pressure plasma (Input discharge power:100W)

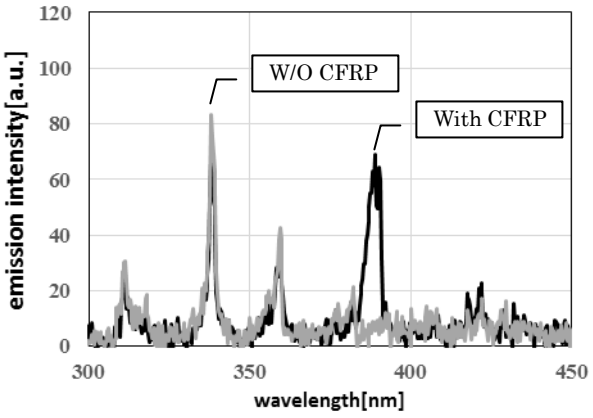

Fig 2. Change of emission spectrum (with and without CFRP)

References

[1] Y. Kouji:"In the future prospects and technological history of carbon fiber composite material", No.6 IEEJ Journal, Vol 134 (2014) 360 *in Japanese.*