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B_4C-Si-Al 系とグラファイトの濡れ性の挙動

Wettability behavior of B_4C-Si-Al and graphite

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1. Introduction

When a liquid and a solid come into contact with each other, a phenomenon called wetting occurs. The angle between the tangent line to the liquid surface at the point of contact between the liquid and solid and the boundary between the liquid and solid is called the contact angle, and the magnitude of this angle indicates the degree of wetting, or wettability. Recently, graphite crucibles have been used in microgravity experiments in space, but they cannot be completely sealed and are encapsulated in three layers of quartz glass or tantalum capsules. Therefore, if graphite can be welded, sealing can be simplified and further material development can be promoted.

If the wettability of boron carbide and graphite can be controlled by adding other elements, the effect on the base material due to the reaction between the base material and the fusing material during welding can be reduced.

In this study, focusing on the electrical conductivity of graphite, we investigated the wettability behavior of the Al-Si-B_4C to graphite by changing its composition using arc discharge and examined the possibility of welding.

2. Methods

Sample preparation was performed in a chamber filled with an argon gas atmosphere. Boron carbide, aluminum, and silicon were placed adjacent to each other on a sample holder made of boron nitride, and aluminum and silicon were attached to boron carbide by irradiating the boundaries with a semiconductor laser.

The experiment was conducted in an argon gas atmosphere in a glove box. The sample was placed on a piece of graphite 5 mm thick and 25 mm × 25 mm in size, and an arc discharge was applied directly above it. A TIG welding machine (RILAND/TIG 200P) was used for the arc discharge and a φ1.6 YWCe-2 electrode. The output current was 100 [A] DC with positive polarity. Arc discharges were performed for 7, 10, 13, 16, and 19 s for one composition, and the wettability behavior of each composition was investigated.

3. Result and Discussion

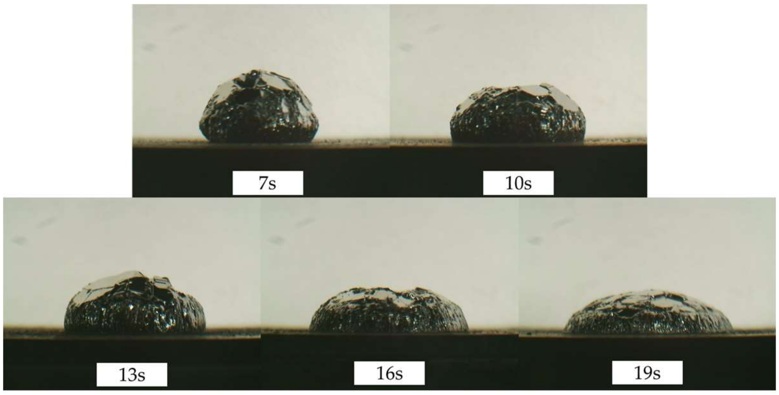

Figure 1 B_4C on graphite

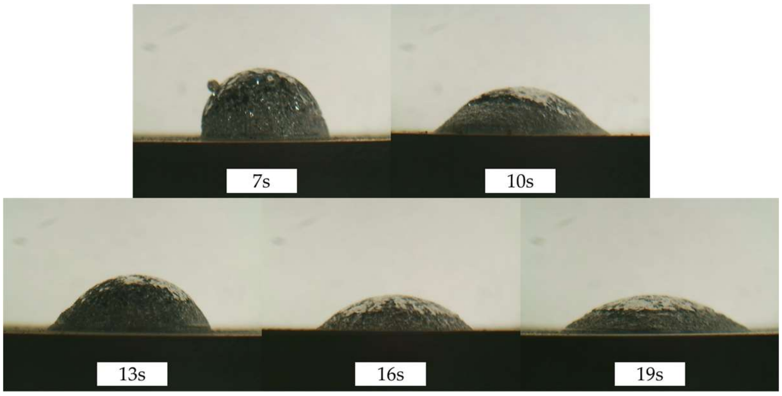

Figure 2 B_4C-Si-Al on graphite

Figure 1 shows the results of arc discharges at different time intervals to verify the wettability of boron carbide and graphite. Figure 2 shows the wettability of graphite with boron carbide, silicon, and aluminum at a composition ratio of 9:1:1.

Figures 1 and 2 confirm that boron carbide, silicon, and aluminum have greater wettability to graphite than boron carbide alone.

4. Conclusion

The results confirmed that the addition of aluminum and silicon resulted in greater wettability than boron carbide alone. Therefore, it is considered possible to weld graphite using boron carbide, aluminum and silicon by TIG welding.