

INFLUENCE OF CARBON ON THE INTERFACIAL CONTACT ANGLE BETWEEN ALUMINA AND LIQUID ALUMINUM

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ABSTRACT

The wettability of alumina by pure liquid aluminum was investigated over the temperature range of 900-1300°C by the sessile drop method under a dynamic vacuum of 10⁻⁴ to 10⁻⁵ Pa. When the substrate is carbon-coated, the terminal contact angle is reduced to 40 degrees at 1300°C for times longer than 75 minutes. In the absence of carbon, the final angle is of 82 degrees for these same conditions. Reactive wetting is suggested by the observation of undercutting of the substrate and ridge formation at the leading edge of the liquid aluminum in all carbon-coated samples. Based on the free energy for the reactions, the following are among the thermodynamically favorable reactions: $4Al + 3C \rightarrow Al_4C_3$ and $C + 1/2O_2 \rightarrow CO$. Possible mechanisms for the observed carbon-enhanced wettability in the system will be discussed.

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