Surface Tension Behavior of Liquid Iron During Adsorption-Desorption Process of Carbon and Oxygen Atoms

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The Fe-C-O system is the most basic system for steel processes, and its surface tension data is essential to simulate Marangoni flow in molten steel. We previously demonstrated that the oxygen is significant surfactant for liquid iron and carbon has negligible effect on the surface tension of liquid iron using an oscillating droplet method combined with a gas-liquid equilibrium method [1]. In this study, we focus on the dynamic surface tension behavior of liquid iron during adsorption-desorption process of carbon and oxygen atoms. We employed an oscillating droplet method using an electromagnetic levitator (EML). Oxygen and carbon activities were controlled using Ar-He-CO-CO_2 gas mixtures. The surface oscillation of the sample was recorded using a high-speed camera. The surface tension was calculated from the surface oscillation frequencies of the droplet using the Cummings and Blackburn's equation. During a carburization process with maintaining oxygen activity constant, the surface tension rapidly decreased after the gas composition was changed, and it gradually increased and returned an initial value. This behavior was caused by transient adsorption and desorption of oxygen accompanied by the carburization. This behavior was reversible during a decarburization process and could be explained by elementary steps of the carburization / decarburization processes.

[1] K. Morohoshi, M. Uchikoshi, M. Isshiki, H. Fukuyama, *ISIJ Int*., **51**(2011), 1580-1586