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Interactions of floating-wire-assisted atmospheric-pressure H_2/Ar plasma with SnO_2 film on glass substrate forming spherical Sn particles[1]

THI-THUY-NGA NGUYEN, Nagoya University, Nagoya, 464-8601, Japan , MINORU SASAKI, Toyota Technological Institute, Nagoya, 468-8511, Japan , HIDEFUMI ODAKA, AGC Inc., Yokohama, 230-0045, Japan, TAKAYOSHI TSUTSUMI, KENJI ISHIKAWA, MASARU HORI, Nagoya University, Nagoya, 464-8601, Japan — Tin (Sn) metal has been extracted from ores for a long time and is a highly demanded material for industrial applications To extract Sn metal from SnO_2, various reduction processes required high-treatment temperatures and reducing agents such as CH_4 that produces CO_2 emission In this study, the floating-wire-assisted atmospheric-pressure plasma using a mixture of 0.05% H_2/Ar gas can reduce SnO_2 film on glass substrate to form Sn spheres without using any additional heater. The H_2/Ar plasma with a high electron density of 10^{14} cm^{-3}, a hydrogen atom density of 10^{14} cm^{-3}, and a rotational temperature of 940 K was obtained at a remote distance of 150 mm. A model for the formation of spherical Sn particles from SnO_2 film on glass substrate in H_2/Ar plasma is presented here. The treatment time and substrate temperature affect the expansion rate of the reduction area and the growth of Sn spheres. The results present a green method to synthesize Sn particles from SnO_2 in atmospheric-pressure plasma for various applications.

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