低周波誘導熱プラズマ炉の試作と巨大クラスター生成への応用

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雑誌名	平成10(1998)年度 科学研究費補助金 基盤研究(A)研究成果報告書概要
巻	1996　1998
ページ	2p.
発行年	1999-12-07
URL	http://doi.org/10.24517/00066091

1998 Fiscal Year Final Research Report Summary

Development of Low-Fregnency Induction Thermal Plasma for Cluster Synthesis

Research Project

Project/Area Number

08555067

Research Category

Grant-in-Aid for Scientific Research (A)

Allocation Type

Single-year Grants

Section

展開研究

Research Field

電力工学・電気機器工学

Research Institution

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Project Period (FY)

1996 – 1998

Keywords

Wide Area Plasma / Plasma Processing / Induction Plasma / High Rate Processing / Inverter / Cluster / Fullerene

Research Abstract

In the third and final year of the project, 1998, a wide area induction plasma was successively generated by using MOSFET inverter power supply with a low frequency of 450 kHz and a power of 50 kW.The reaction area of the plasma is as wide as 150-mm diameter and 150-mm length, which enable us the high speed processing or synthesis of materials. C_<60> fullurene synthesis was carried out by using Ar, He and CO_2 induction thermal plasmas. Remarkable results are as follows.
1) The transistor inverter supply was found to be useful to establish the inductively coupled plasma with a frequency of 450 kHz. At a power level of 30kW, several kinds of plasma can be generated in Ar, He and CO2 gas circumstance. The CO2 plasma was found to have relatively high temperature around 10,000 K compared to Ar and He plasma.
2) These induction thermal plasmas were sufficiently stable for the injection of cold carbon powders up to a rate of 10 g/min, which is high enough quantity to produce the C_<60> cluster with a high rate.
3) Among the experiments carried out under several conditions with respects to the gas sort, pressure and the power of plasma, Ar/He noble gas plasma showed the most highest C_<60> synthesis rate, while the dissociative CO_2 gas plasma showed no synthesis of C_<60>. The results indicate that a strong quenching effect of the radical C atom and C_2 molecule is essential for the synthesis of such high order fullurene materials.

Research Products (10 results)

All | Other

All | Publications (10 results)

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URL: https://kaken.nii.ac.jp/report/KAKENHI-PROJECT-08555067/085550671998kenkyu_seika_hokoku_

Published: 1999-12-07