



Others

Starting Stage

(Fiscal Year 2002-2004)

Matsuyama Area

Innovation of Production Technology with In-liquid plasma application technology

Ehime Industrial Promotion Foundation
 337-1 Kumekubotamachi, Matsuyama City, Ehime 791-1101
 Tel: +81-89-960-1100

Core Research Organization
 Ehime University

Major Participating Research Organizations
 Industry...About 100 organizations in this area
 Academia...Ehime University
 Government...Industrial Research Center of Ehime Prefecture, Ceramics Institute of Ehime Prefecture

Typical result of City Area Program

1. Development of in-liquid plasma device for decomposition of substance

The RF circuit for a stable plasma generation was designed, and the equivalent circuit of the plasma generator was determined. As a result, a modeling of the plasma impedance in order to design a plasma reactor was established, and a stable plasma reactor using microwave and high frequency wave with high energy efficiency was produced.

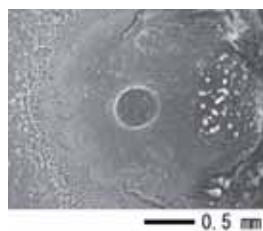
By using this device, harmful substances feared as an environmental problem such as emission of fluorocarbon, dioxin, and PCB can be decomposed and be made harmless more than conventional method, since it does not depend on this type of the liquid and the plasma can be generated in a variety of liquids.



High frequency in-liquid plasma generator

2. The material synthesis by using in-liquid plasma

The synthesis of the polycrystal silicon carbide with smooth surface and few graphite in silicon oil, the synthesis of carbon nanotubes in benzene solution containing ferrocene, and the deposition of diamond-like carbon film on carbon fiber in n-dodecane, were succeeded respectively. The high density plasma could be efficiently generated in water, and the in-liquid plasma device, which may synthesize various materials in a large quantity with high speed was developed.



SEM photo of polycrystal SiC film

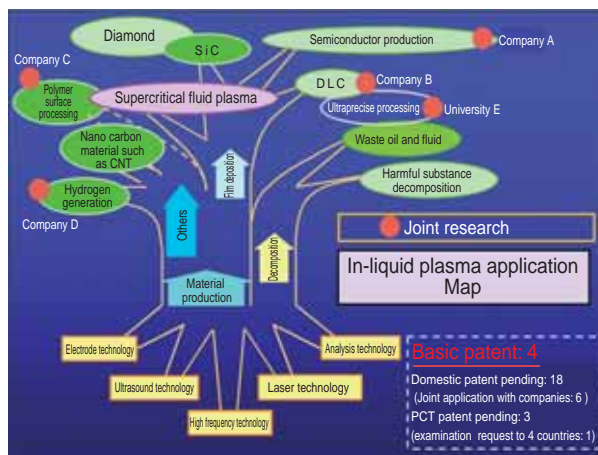


TEM photo of carbon nanotube

About the approach after the project

1. Establishment of center for in-liquid plasma investigation and promotion of a joint research

The in-liquid plasma application technology research project is established in the cooperation of Department of Engineering, Department of Science, Department of Agriculture, and The Integrated Center for Science in Ehime University. The research and development of in-liquid plasma process, sono-process, and the laser measurement technology has been advanced. Moreover, a joint research with another university and four companies is promoted on the development of in-liquid plasma equipment and the development of the high speed large area semiconductor deposition technology. Three domestic patents and one U.S. patent have been acquired. After the CITY AREA PROGRAM ends, a lot of patents were submitted.



Map for technology research of submerged plasma

2. Development of conventional small decomposition device

The in-liquid plasma device was developed by inserting a special electrode in a conventional microwave which is available in the market. It proposed the mass production device for the consumer electronic. By using this device, the hydrogen of the purity 80% was obtained from waste oils.

This device can produce the hydrogen in the efficiency of about 30% of the electrolysis of alkali water solution. It is expected to be used as a consumer hydrogen station.