



1. Plasma on diamond
2. Miniature microwave torch

## MICROWAVE TECHNOLOGY

### Fraunhofer USA Center for Coatings and Diamond Technologies (CCD)

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### Plasma Source Development

Fraunhofer USA Center for Coatings and Diamond Technologies and Michigan State University were inspired to join forces by complimentary expertise in coating technology, microwave plasma and microwave materials processing technology. The result: Fraunhofer USA CCD. The center is able to offer systems and processes covering the complete spectrum of plasma design and development, reactor design and development, as well as process optimization all the way through to industrial system integration.

Exceptional expertise in the modeling, design, diagnostics and control of microwave plasma sources and system reactors make the center your ideal choice of partner in plasma source and system design in addition to process development.

### Expertise

With over 30 years of industry-focused research in this field our capability covers a broad spectrum of processes including:

- Low pressure ECR (Electron Cyclotron Resonance) – plasma etching technology used in Integrated Circuit manufacturing.
- Thrusters and ion sources
- PACVD – Plasma Assisted Chemical Vapor Deposition
- Atmospheric Pressure – Miniature plasma sources

We have extensive experience in developing and designing a range of plasma sources – from large area to miniature as well as reactors and fully integrated systems.

Large area includes the design and development of an industrial scale 915 MHz CVD

IN COOPERATION WITH

**MICHIGAN STATE**  
UNIVERSITY



diamond deposition system. Using this technology, it is possible to uniformly grow polycrystalline diamond over 6" silicon wafers. This can be used for applications such as sensors, MEMS, wear and optical parts.

We create miniature microwave plasma sources and reactors by applying plasma discharges with sizes ranging from 0.2mm to several mm.

Applications for this technology include coating the inside of tubes and parts, plasmas-on-a-chip and local area materials processing with plasmas.

### Reactor Design and Process Development

Whether using single mode or multimode applicators, a miniature or large area source, here at CCD we have the know-how necessary to design and integrate complete systems.

This expertise enables us to offer technology to industry for microwave materials processing activities such as: heating, curing and sintering. There are applied to the treatment of optical fibers, composite materials and textile materials, etc.

Application examples for microwave plasma technology include:

- CVD Diamond for optical and electronic applications
- Curing of polymers and adhesives
- Microplasmas for spectroscopy
- Plasma torch for materials processing

### What We Offer

Working with equipment manufacturers, we design, develop and implement plasma sources and reactor systems for our industrial and government customers. In addition we are able to offer modeling expertise to support all aspects of the technology.

Our combined knowledge and facilities enable us to provide an integrated service on all aspects of microwave plasma, systems and materials processing. This includes consulting, numerical modeling, plasma characterization techniques, process diagnostics and system development.

For more information please contact [CCDinfo@fraunhofer.org](mailto:CCDinfo@fraunhofer.org)

1. Single crystal diamond
2. Simulation of the temperature distribution of different microwave plasma sources

