●Basic Stage

(Fiscal Year 2006–2008)

East Kanagawa Area

Development of Environmental-friendly Functional Surface Technologies and Their Transfer through "Public Prototyping Activities"

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Life Sciences
IT
Environment
Nanotech Materials
Others

Framework for Project Promotion

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Major Participating Research Organizations

Industry···KGU-SERI Co. Ltd., KANTO KASAI CO. LTD.,
NISSAN MOTOR CO. LTD., Plating Industries Association of Kanagawa
Academia···Keio University
Government···Kanagawa Industrial Technology Center (KITC)

Core Research Organizations

Kanagawa Industrial Technology Center (KITC), Keio University Faculty of Science and Technology, Kanto Gakuin University Surface Engineering Research Institute (KGU-SERI)

Aims of Project

One of the critical challenges faced by surface coating/treatment industries is the recent enforcement of environmental restrictions, such as the RoHs Directive in the E.U., and their global expansion. In light of the response to such trends, this project is aimed at creating cost-effective manufacturing technologies with the added value of "environmental friendliness," and through their transfer, to provide local businesses, particularly small- and medium-size enterprises (SME's), with new competitiveness and advantages in the global market.

For these purposes, we will develop the following manufacturing technologies.

1. High-Speed Atmospheric-Pressure Plasma CVD of Large Surface DLC Films for Novel Functional Components
2. Pretreatment of Resin Surface Using TiO_2 Photocatalyst for Metal Plating.
3. Pre- and Post-treatment for Metal Plating with Low Environmental Impact and Simplified Quality- and Process-Control Techniques and Tools.

Furthermore, we will design, establish, and operate "Public Prototyping Activities" with the capability of sample supply in a semi-mass- or mass-production scale to enable effective technology transfer of the development results to SME's.

Contents of Project

1. High-Speed Atmospheric-Pressure Plasma CVD of Large Surface DLC Films for Novel Functional Components

Through the evaluation of the characteristics of DLC films, such as hardness, antiwear resistance, friction, and gas barrier properties, manufacturing parameters will be optimized, and real-scale continuous coating equipment will be designed and built. In addition, coating technologies will be developed for the application of DLC on substrates, such as light alloys or resins, which have been assumed to be hard to coat with DLC. The equipment developed will be operated in the future "Public Prototyping Activities."

2. Metallization of Polymer Surface Using TiO_2 Photocatalyst

To strengthen the adhesion of metal films plated on polymers, pretreatment technology using the photocatalytic function of TiO_2, which is expected to replace the on-going decomposition using hazardous chemicals such as chromium acid, will be developed. A mass-scale production line will be built and utilized for the "Public Prototyping Activities."

3. Pre- and Post-treatment for Metal Plating with Low Environmental Impact and Simplified Process-Monitoring and Quality-Control Techniques and Tools

- Effective and environmentally mild techniques for degreasing and the removal of various contaminants on the substrates.
- Chromium-free and highly anticorrosive water-repellent protective top coat film for metal-plated surfaces.
- Simplified optical or electrochemical sensing techniques and tools that enable on–site and real-time management of a plating bath or of product quality, such as a glossy appearance.

Main Results

1. DLC films with a high gas barrier property were successfully formed on plastic films by high-speed atmospheric pressure plasma CVD (AP-CVD) technique.
2. On the basis of the AP-CVD technique mentioned above, not only a roll-to-roll typed system for continuous coating method, but also a batch typed large-scale system for testing apparatus have been built up for utilization as a "Public Prototyped Instrument."
3. A pre-treatment technique has been developed, which improves substantially the adhesion ability of DLC films on aluminum-rich alloy surfaces.
4. High quality adhesional thin coating of resinous surface has beensuccessfully performed either by TiO_2 photo-catalytic reactions in water or by UV irradiationunder dried conditions.
5. A series of inhibitors applicable to the electro-plating processes have been developed, which are highly effective for protection of metallic surface as well as removal of metal oxide contaminations on the surface.
6. "Eco-Surface Society" and its four working groups including more than one hundred companies and public research organizations, have been organized and the have just started a joint research activity to facilitate the transfer of the research outcomes as a leading organization for "Public Prototyped Activities."

Roll-to-roll typed system for DLC films by high-speed atmospheric pressure plasma CVD technique