Requests for Collaboration

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Research Interests

- Electrical properties of filler dispersed polymer
- Crystal structure of polyvinylidene fluoride
- New lithography technology.
- Chemical reaction analysis between radicals and resist

Creative Achievements in The Application of New and Existing Science and Technology

(1) Electrical properties of filler dispersed polymer

When the conductive particles are filled in the polymer, the electrical resistance increases with the temperature rise. This material shows low resistance at room temperature. On the other hand, when the temperature rises, the resin expands in volume, the distance of the conductive particles increases, and the resistance increases. This material is applied to a circuit protection element.

(2) Control of crystal structure of PVDF

Quartz glass has excellent ultraviolet ray transmittance, but because it is easy to break and is expensive, we develop an alternative polymer. Using blends of polymethyl methacrylate (PMMA) and polyvinylidene fluoride (PVDF), we try to control the crystal structure of PVDF to improve the ultraviolet ray transmittance. In addition, we are searching for a method for preferentially preparing energetically unstable type 1 crystals (piezoelectricity, pyroelectricity) from a PVDF thin film using solvent casting.

(3) Development of new lithography technology

Densification of semiconductors and liquid crystal devices is advancing at a remarkable speed, and it is needed to process finer patterns in a shorter time. It is important to develop the resist with high resolution and high sensitivity. Specifically, we are developing 3-component resists for EUV (base resin, dissolution inhibitor, acid generator).

(4) Chemical reaction analysis of radicals and resist (Development of environmentally friendly resist removal)

In device manufacturing, chemicals harmful to the resist removal process are used. We develop an environmentally friendly resist removal process by using ozone or hydrogen radical. Basically, it analyzes the non-equilibrium reaction of gas phase (ozone / hydrogen radical) - solid phase (resist).

Technology (Product, Process, Device, Service etc.) That I Want to Request for Collaboration

See above.

A List of 5 Key Publications

・Development of Photo-resist Removal Method Using Ozone Gas with Water Vapor for LCD manufacturing, S. Noda, M. Miyamoto, **H. Horibe**, M. Kuzumoto, and T. Kataoka, *J. Electrochem. Soc.*, **150**(9), G537-G542 (2003).

・Poly (vinylidene fluoride) Crystal Structures of Poly (vinylidene fluoride) / Poly (methyl methacrylate) Blends after Annealing, **H. Horibe** and M. Taniyama, *J. Electrochem. Soc.*, **153**(2), G119-G124 (2006).

・Removal of Ion-implanated Photoresist by Using Atomic Hydrogen
M. Yamamoto, T. Maruoka, A. Kono, **H. Horibe**, M. Sakamoto, E. Kusano, H. Seki, and S. Tagawa, *J. Electrochem. Soc.*, **157**(3), H361-H370 (2010).

・Positive-temperature-coefficient effect of electrical resistivity below melting point of poly(vinylidene fluoride) (PVDF) in Ni particle-dispersed PVDF composites, A. Kono, K. Shimizu, H. Nakano, Y. Goto, Y. Kobayashi, T. Ougizawa, and **H. Horibe**, *Polymer*, **53**(8), 1760-1764 (2012).

・Resistivity-Temperature Characteristics of Filler-Dispersed Polymer Composites, H. Nakano, K. Shimizu, S. Takahashi, A. Kono, T. Ougizawa, and **H. Horibe**, *Polymer*, **53**(26), 6112-6117 (2012).