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Integration of biocompatible MEMS by gold electrodeposition using supercritical carbon dioxide

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The flexible properties of polymeric material make bio-MEMS promising candidates for the next generation of micro devices. However there have been many difficulties to overcome in fabrication process. Supercritical carbon dioxide (sc-CO₂) is generally viewed as a replacement for harmful organic solvents used in extractions, separations, chemical reactions, molding, and many other applications because CO₂ is non-polar and the tunable physical properties between a gas and a liquid. Especially for application of sc-CO₂ in fine wiring technology, transfer of materials into and out of fine nano-space can be improved to allow proper cleaning and complete filling of the nano-spaces. Thus we have studied an application of sc-CO₂ into integration of bio-compatible MEMS. We examined sc-CO₂ for washing of photoresist pattern on substrate and completed washing the pattern with strengthening the adhesion. We have also proposed a washing process using emulsion of sc-CO₂ in water for eliminating the resist pattern from the substrate. We now have studied metalizing of gold on polyimide, which is composed of catalyzation process on/into polymer using sc-CO₂ of Pd-organic complex and electroless plating using sc-CO₂ emulsion (ELP-SCE), which is composed of an aqueous electrolyte, sc-CO₂, and a surfactant. ELP-SCE enabled the penetration of Pd into deep-inside of polymer. So Pd seed-layer can be deposited on polyimide. We also have studied gold electroplating method using sc-CO₂ emulsion (EP-SCE). Metal film obtained by this technique was uniform and without pinhole, because sc-CO₂ has low viscosity and compatibility of hydrogen. Thus, we have proposed and examined a void-free gold wiring on the Pd seed layers/polyimide. This method is applicable into bio-compatible MEMS.

Biography

Masato Sone completed his Doctor's degree of Engineering at the age of 28 years old at Tokyo Institute of Technology. He worked as a Researcher in Nippon Oil Company from 1996-2000. He was an Assistant Professor and then a Research Associate Professor at Tokyo University of Agriculture and Technology from 2000 to 2005, and he got the position of Associate Professor at Tokyo Institute of Technology from 2005 until present time. He has published more than 110 papers in scientific journals. His majorities are microelectronics, surface finishing, chemical engineering, liquid crystal and polymer science. His recent topic has been novel nano wiring process using supercritical carbon dioxide for integrated circuit technology.

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