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Application of supercritical carbon dioxide into 3d integration of metal oxide/metal on polymer for biosensor and bioelectronics

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Abstract

The flexible and biocompatible properties of polymeric material make polymer MEMS promising for next generation of micro devices. However, there are many difficulties in the fabrication process. Supercritical carbon dioxide (sc-CO_2) is an intermediate media between gas and liquid and has low viscosity like gas and high density like liquid. We have studied applications of sc-CO_2 into fabrication of integrated circuit, MEMS and bio-sensing devise.

We examined sc-CO_2 for washing of photoresist pattern of SU-8 and have completed washing the patterns with strengthening the adhesion between SU-8 and substrate. This strengthening is effective but we also have to remove the pattern from the substrate. Thus we have proposed a new washing process using emulsion of sc-CO_2 in water for eliminating the resist patterns and found that this application of the emulsion is effective. We have also studied metalizing of Ni-P on polyimide, which is composed of catalyzation process on/into polymer using sc-CO_2 solution of Pd-organic catalysts and electroless plating using emulsion with sc-CO_2 in electroless plating electrolyte. The electroless plating process enabled the penetration of Ni-P into deep-inside of polymer and give strong adhesion between polymer and metal. Moreover, electroplating using emulsion with sc-CO_2 in electroplating electrolyte realized wiring of Cu into fine nano-scale hole with high aspect ratio because of high diffusivity of the electrolyte. Thus the application of sc-CO_2 can realize an innovation for fabrication of MEMS or bio-sensing devise.

Biography

Masato Sone completed his doctor degree of engineering at the age of 28 years old at Tokyo Institute of Technology. He worked as a researcher in Nippon Oil Co. Ltd. from 1996 to 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 100 research papers in international journals, 9 books and 29 patents including USP and EP. His majorities are microelectronics, surface finishing, material science and polymer science.