Fundamental study of ultraviolet-ray excited machining

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When the light excitation substance such as a high polymer absorbs the light energy of an ultraviolet ray, it will be excited. If its substance reacts with the processing material in an atomic order under the excited conditions, it may be available for fine processing. Thus, it seems that the processing in a sub-nanometer order may be realized by the phenomenon that is called the luminescence. The following merits can be considered; 1. Little reaction heat. 2. Little heat influence to a processing material. 3. Easy and clean reaction control in comparison with the chemical processing.

In this research, the processing principle is verified by dipping the processing material for a fixed time in pure water that is mixed the fluorescent substance glared by an ultraviolet ray. The surface of copper that was precisely lapped is used for an experiment. The abrasion of its surface is observed by AFM.

This paper describes the processing characteristics of copper which ultraviolet ray was exposed on. The irradiation of ultraviolet ray increased the corrosion rate of copper, and the surface roughness becomes small. The irradiation by ultraviolet ray improves the surface roughness over all condenses of processing liquid. The minimum surface roughness was obtained at the appropriate irradiate time, pH, and the height or liquid level. The temperature arise of liquid decreases the surface roughness of copper.

Then the process of polishing the copper verified the processing principle using a newly developed ultraviolet polisher. This paper describes the abrasive characteristics of copper polished in a mixed liquid of fluorescent substance and photocatalyst exposed to ultraviolet light. Ultraviolet irradiation increased the corrosion rate of copper, and the surface roughness became small in the case of aluminum oxide. However, the surface roughness became large in the case of titanium oxide, The findings of this study indicated that the photocatalyst titanium oxide has excessive action of oxidation for copper.