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Solution plasma can be used for various applications including nano particle synthesis and liquid treatment. However, there are few reports on thin film formation using solution plasma. In this work, we report that we can synthesize a free-standing film, which is cross-linked polymer with embedded gold nano particles (GNPs), on an aqueous solution irradiated with dielectric barrier discharge (DBD). The aqueous solution was HAuCl<sub>4</sub> aqueous solution with gelatin. Applied voltage was bipolar pulse voltage, Typical discharge time was 10 min. Discharge gas was argon. A film is formed on the aqueous solution by irradiating DBD plasma on the aqueous solution. IR absorption spectra of the film and EDX spectra indicated that the films were made of GNP-embedded cross-linked gelatin. A TEM image of the sample indicates that the synthesized GNPs are densely incorporated in the film. The size of GNPs seems to be regulated. We have investigated effects of voltage polarity on the GNP formation and polymer film formation. We have found that increase in the positive pulse voltage enhances formation of GNPs, while increase in the negative pulse voltage does not.

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