## §6. Influence of Microwave in Surface Plasmon of Metallic Nanoparticles

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The synthesis of metallic nanoparticle for the fuel cell and catalyst by using the microwave dielectric heating is advanced at last few years. The particle shape and size can be controlled by the microwave method, and the problem of conventional methods can be improved. However, the mechanism of microwave effect in the nanoparticle synthesis is not clarified. The microwave effect in the metallic nanoparticle synthesis was observed in this present study, the device that divided the magnetic and electric fields as the microwave element was separated by the novel microwave apparatuses, and the change in the surface Plasmon absorption was observed with the in suite spectroscope.

**Experimental setup**: The diaminesilver(I) precursor complex, $[Ag(NH_3)_2]^+$ solution that was the starting material of the silver nanoparticle was made a mix sample in carboxymethylcellulose (CMC) dispersing agent solution. Semiconductor microwave generator (2.45GHz) was used as a microwave applicator with single mode microwave apparatuses. The quartz reactor with a sample solution set up the maximum magnetic and electric field in the waveguide. The UV/Vis spectrophotometer set up on the waveguide side, and observed the Plasmon absorption continuously at the irradiation time the microwave (**Figure 1**).

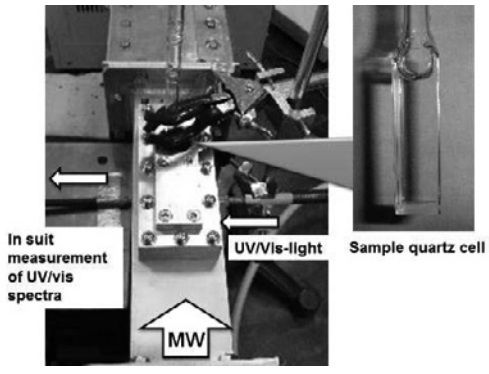


**Figure 1** – Experimental setup of microwave nanoparticle synthesis system

**Result and discussion**: The Plasmon absorption of Ag nanoparticles to the electric field irradiation is shown in **Figure 2**. The seed of Ag nanoparticle is promptly and uniformly formed at the less than 1 nm. The Plasmon absorption was observed at 635 nm with the initial irradiation. Afterwards, the Plasmon absorption (420nm) was rapidly shifted by the temperature rise (100℃) of the solution. And then the peak shifts red to 460 nm with an increase of particle diameter. On the other hand, the change in the Plasmon absorption according to the irradiation of the microwave was neither observed in the magnetic field heating the generation of nanoparticles did not progress. The $Ag^+$ ion can be expected not to be heated from no progress of the generation of nanoparticles in the magnetic field by the microwave selectively though it is known that the resistance heating by the magnetic field progresses in solution that is contained the ion in an existing microwave heating.

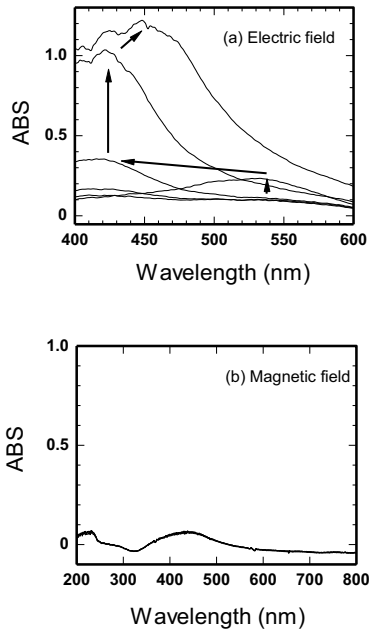


**Figure 2** – Plasmon absorption spectra for Ag nanoparticle under electric field (a) and magnetic field (b) of microwave

1) Horikoshi, S. et. al. : Nanoscale (2011) submitted.