Visualization of Sub-50 nm Particle Detachment from Silica glass Substrate during Enforcing Mega sonic by Evanescent Field

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Post-CMP Cleaning phenomenon is considered as the detachment of the nanoparticle from the substrate to be cleaned, and the occasional reattachment of the nanoparticle to surface in nanoscale. However, residual contamination on the substrate has been usually inspected only after the cleaning process. Therefore, the cleaning mechanisms of nanoparticles has not already clearly known. Hence, we have established dynamically observation of cleaning phenomena near the surface by applying the evanescent light which occurred a few hundred nm from the surface to be cleaned.

The experimental results showed that scattering light from different sized Au and silica standard nanoparticle on the silica glass substrate was proportional to the square of the particle diameter (**Fig.1**). Therefore, the particle size can be determined by calculating backward from the scattering light intensity.

Moreover, **Fig.2** shows our mobile experimental setup to observe the Mega sonic cleaning phenomena. The evanescent field and dark field were generated by the 532 nm laser beam. The cleaning phenomenon was recorded with an area CMOS sensor in 1000 frames per second.

Detachments of ϕ 30 nm Au particle and the cavitation effect were observed during enforcing 1.1 MHz waves (**Fig.3**). The typical phenomenon was demonstrated that some of Au particles randomly intermittently are detached from the surface within 1.0 millisecond after the cavitation effect repeatedly irregularly occurs and decays near the surface. Furthermore, similar trend of phenomenon was observed in case of silica nanoparticle, and it will be described in full paper.

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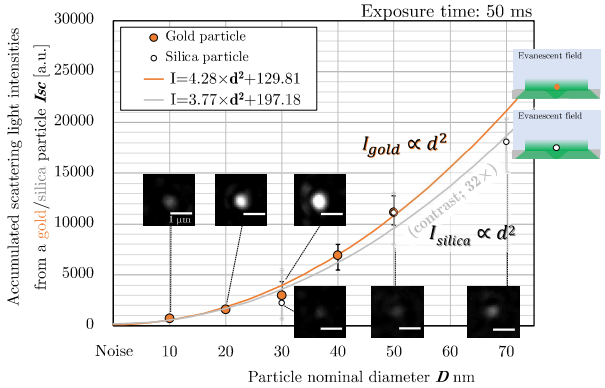

Fig.1 Scattering light intensities from different sized Au and silica particle on the silica glass substrate in an evanescent field

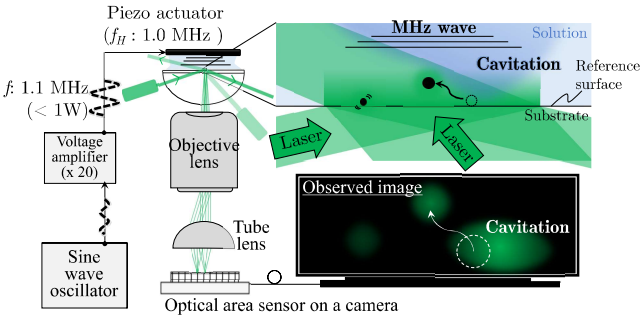

Fig.2 Experimental setup to visualize nanoparticle behaviors during enforcing MHz wave

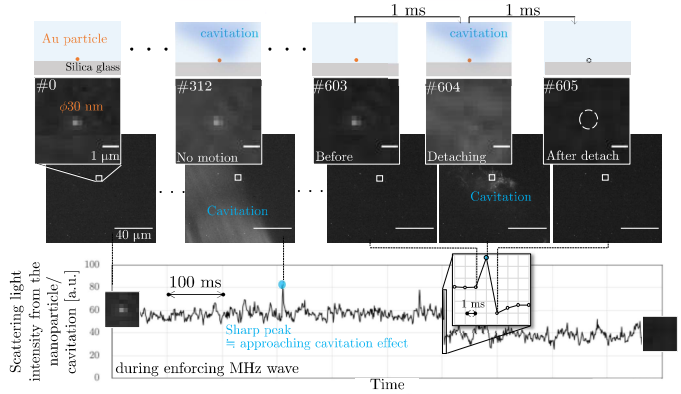

Fig.3 ϕ 30 nm Au particle behavior during enforcing 1.1 MHz waves recorded in 1000 fps

Preference: ☑ Oral ☐ Poster
Topic Area: Defects and Post CMP cleaning