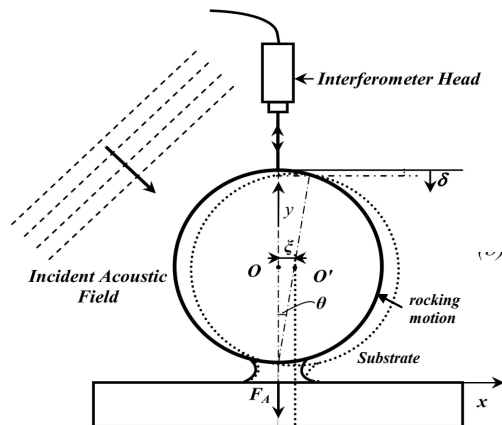


Topic : **Work-of-Adhesion Measurements of Chemical Toner Particles**
 Duration : **2007-Present**
 Sponsor(s) : **Xerox Corp. and CAMP/Clarkson University**
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Synopsis of Research and Sponsored Projects

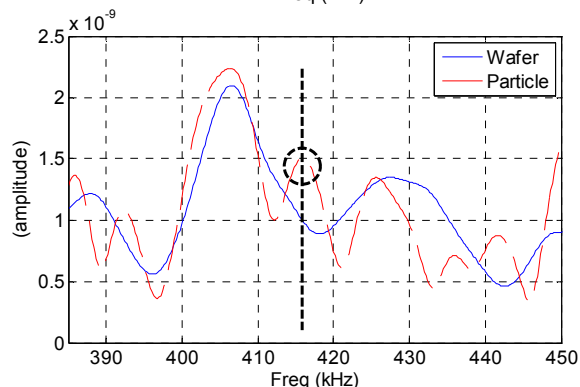
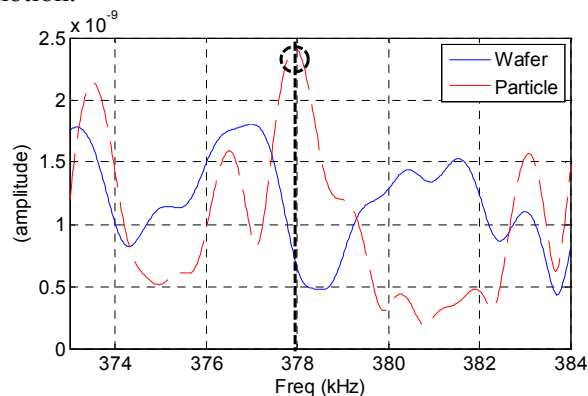
In photocopying and printing, new generation chemical toner has various superior properties over traditional pulverized toner. However, research is required to understand adhesion properties of these particles and their relations to a number of other relevant parameters to take full advantage of this toner. In current study, two non-contact methods are employed to measure work-of-adhesion of an individual toner particle. It is demonstrated that work-of-adhesion can be extracted from the resonance frequencies of rocking motion of a particle under acoustic base and air-coupled excitations.

To measure the transient rocking response of single $9\mu\text{m}$ particles, it is excited by a piezoelectric transducers with a central frequency of 3.5 MHz on silicon substrate. For acoustic air-coupled excitation, the toner particle is excited by an air-coupled transducer from the side at a central frequency of 250 kHz. Both axial and rocking motions take place under these excitations. However, in current study, it is found that the stiffness of the out-of-plane bond is much stronger than that of the rolling bond, and, consequently, the out-of-plane displacement δ is largely due to the rocking motion of the particle.



To measure the transient responses of the excited particle and silicon wafer substrate, an interferometer is employed. The frequency

response functions are calculated to distinguish the resonance frequencies of the particle from those of the silicon wafer pieces. In the frequency response spectrum, the peaks which do not correspond to the resonance frequencies of the wafer piece are for the resonance frequencies of the rocking motion.



The values of these unique frequencies are used to determine the work-of-adhesion between the toner particle and the silicon substrate. The effects of various factors such as nanoparticle coating, electric charge on the particle, and humidity can be studied by these two acoustic techniques.

References

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2. M. D. M. Peri, Cetin Cetinkaya, *Air-coupled excitation of rocking motion of individual microspheres on surfaces*, Applied Physics Letters, 90, 171906, 2007.