Micron-Powder Blending, Transportation and Separation using Surface Acoustic Waves

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A nano- and micron-scale powder transportation, blending and separation provide the fabrication of chemical platform for drug-discovery using micro total analysis systems (μTAS) or micro-chemical devices. Especially, a surface acoustic wave (SAW) device is attracting the most attention for the powder transportation, blending and separation in the μTAS platform. [1] A lot of experimental data for fluidic transportation including the droplet transportation have revealed that the direction of the fluidic propagation is parallel to the propagation direction of SAW and its velocity increases roughly linearly with the amplitude electoelastic SAWs.[2, 3] However, an understanding of the underlying mechanism of powder transportation by SAW is lacking because the direction of the powder transportation is opposite with respect to the fluidic case and its velocity is not linearly changed for the input power as shown in Fig. 1.

In order to exploit the mechanism of powder transportation with SAWs to drive an extraordinary powder transportation, blending and separation phenomena, we measured the material dependence of the powder transportation by SAW. Here, we fabricated the micron-scale inter digital transducer systems by photolithography and micro-fabrication technique. Using the fabricated systems, we demonstrated and compared such phenomena in the modeling and simulation based on particle hydrodynamics. Within this approach, we reveal the driving force transmission mechanism is dependent on the friction and specific gravity.

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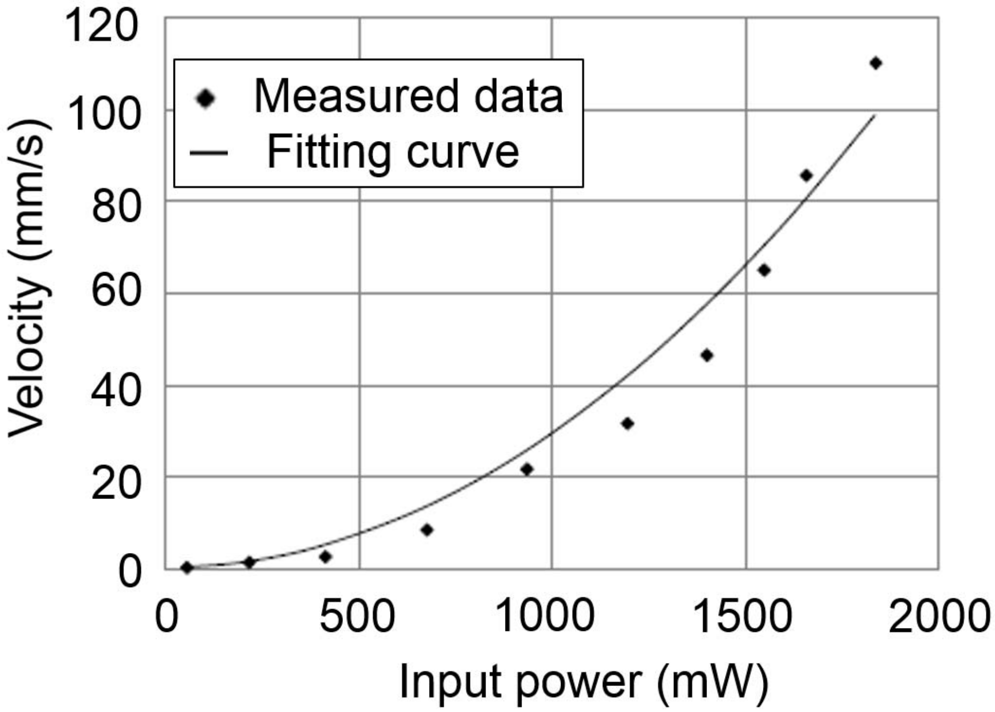

Figure 1: The propagation velocity as a function of input power: We fabricated the 200 μm-wide Inter Digital Transducer (IDT) made of Cr/Al onto a $LiNbO_3$ substrate (128-degree rotating Y plane and X propagation) by means of micro-fabrication technique. We measured the propagation velocity of powders such as Cu, Ni, polystyrene and Liquid-marbles as a function of the input power. In this figure, we show the input power dependence of the propagation velocity of the Cu particles with 6.8 μm diameter. The velocity increases nonlinearly with the input power and is in good agreement with the fitting curve.