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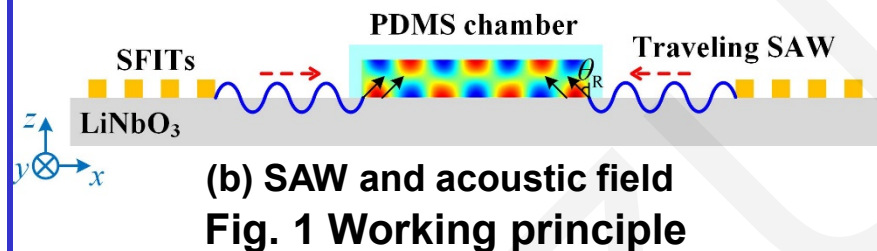
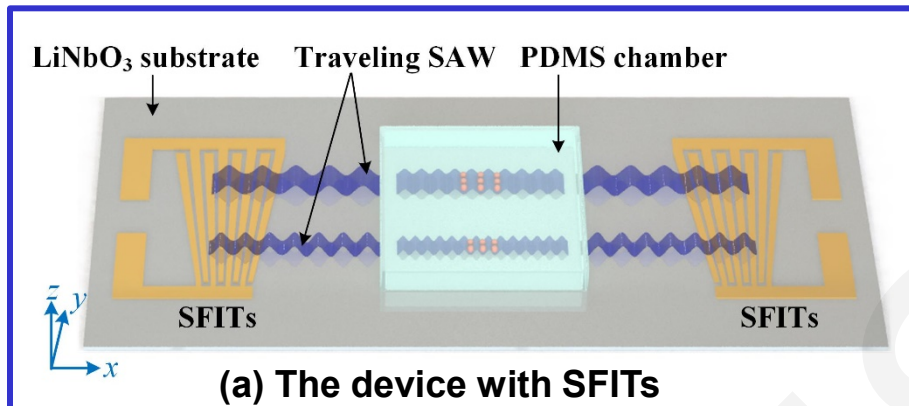
Tunable patterning of microscale particles using a surface acoustic wave device with slanted-finger interdigital transducers

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Key words:

Tunable patterning; Surface acoustic wave (SAW); Acoustic pressure field; Polymer-based composite; Slanted-finger interdigital transducers

Working Principle



$$F_r = - \left(\frac{\pi p_0^2 V_p \beta_m}{2\lambda} \right) \phi(\beta, \rho) \sin(2kx) \quad \phi(\beta, \rho) = \frac{5\rho_p - 2\rho_m}{2\rho_p + \rho_m} \frac{\beta_p}{\beta_m}$$

□ Patterning principle

- Localized piezoelectric effect
- Acoustic field in chamber
- Acoustic radiation force on particles

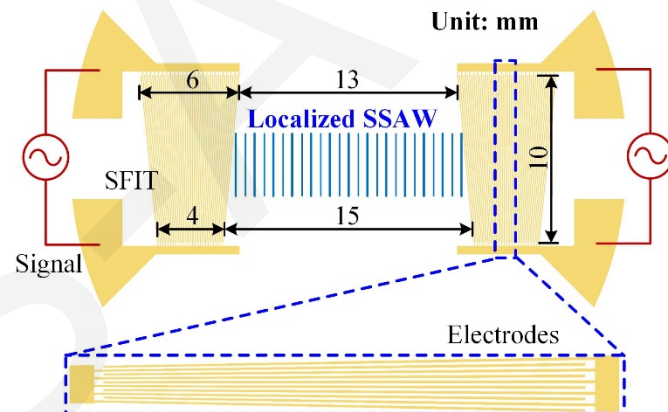


Fig. 2 Structure of the SFITs

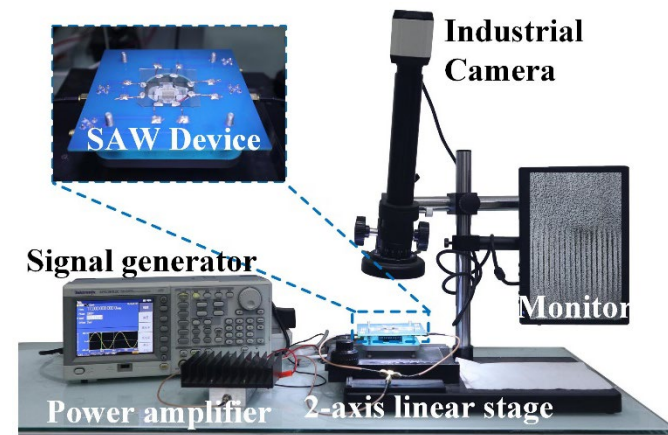
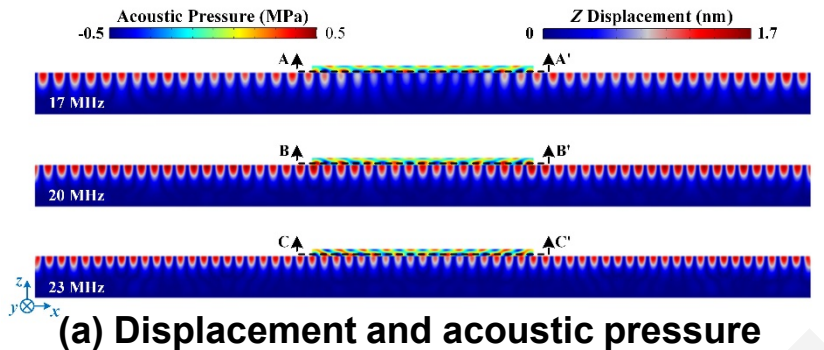


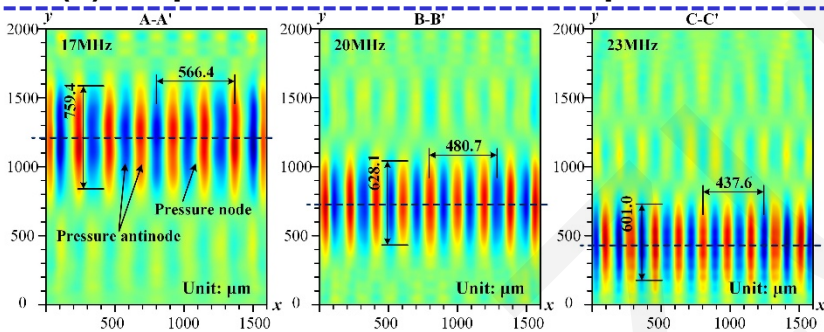
Fig. 3 Experimental setup

Results and Discussion

■ Simulation Results



(a) Displacement and acoustic pressure



(b) Acoustic pressure in PEGDA

Fig. 4 Simulation of single signal

□ Results

- Two regions of patterned pressure fields were generated with multi-signal.

□ Results

- Surface acoustic wave was excited in a narrow region, and propagated along the x direction.
- The period of the acoustic pressure field decreased as the frequency increased.
- The width of the acoustic pressure field also tended to decline.

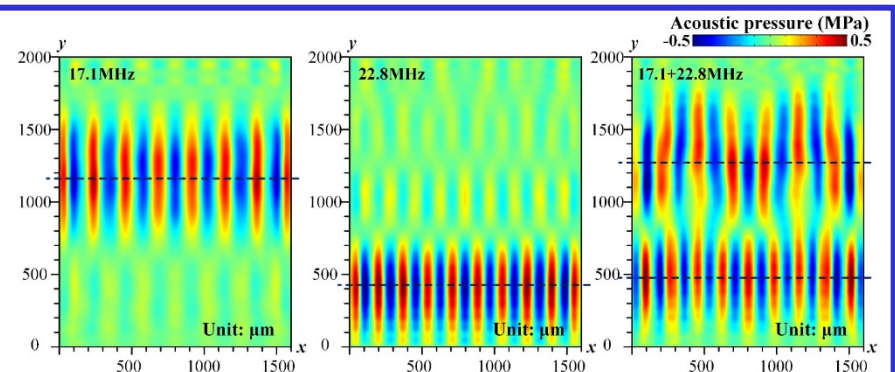
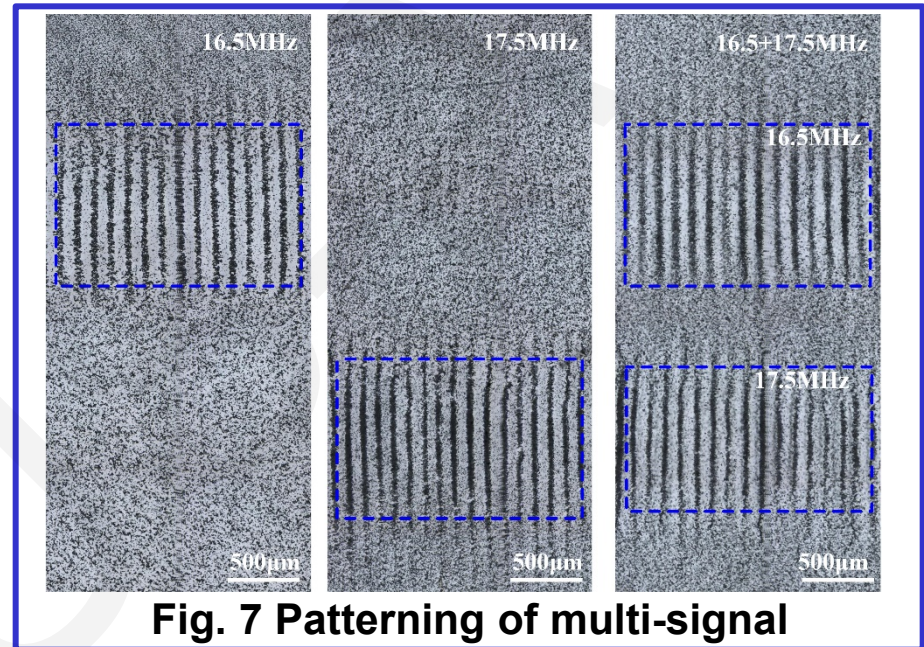
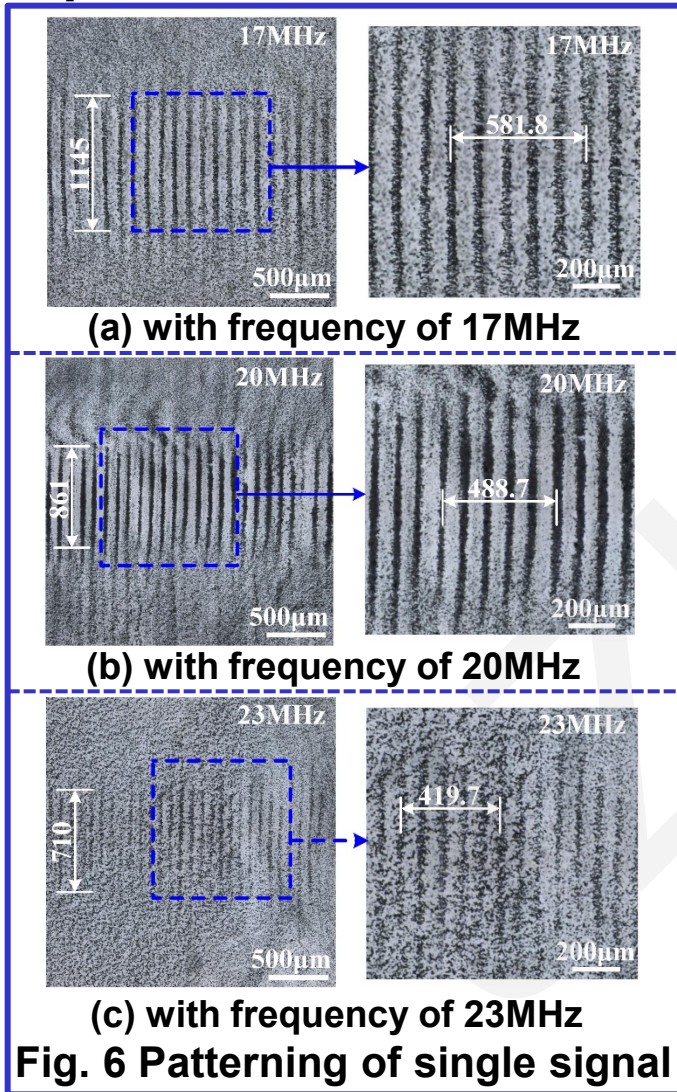


Fig. 5 Simulation of multi-signal

Results and Discussion

■ Experimental Results



□ Results

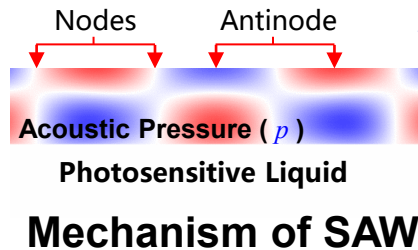
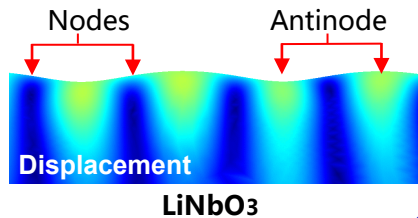
- Particle patterning with a period around 83.9 to 116.4 μm , and a width of about 710 to 1145 μm can be achieved.
- Particles can be patterned into different patterning in one sample.

Conclusions and Future Work

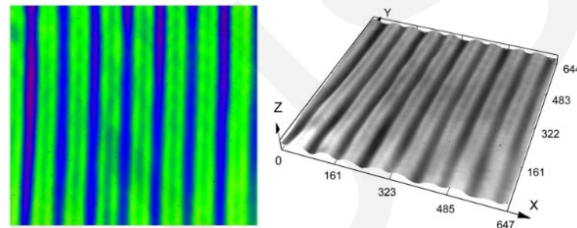
Conclusions

- The method based on a SAW device with slanted-finger interdigital transducers (SFITs) can achieve **tunable particle patterning with a period shifting from around 83.9 to 116.4 μm** , and a **width of about 710 to 1145 μm** .
- The **period and width of pattern decrease with the frequency increasing**, and the **period** is about half the wavelength of the surface acoustic wave.

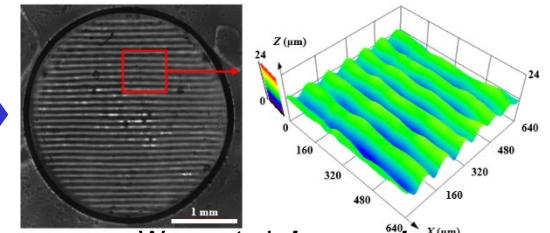
Future work



Microstructure

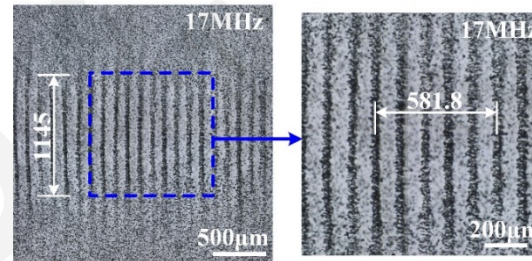


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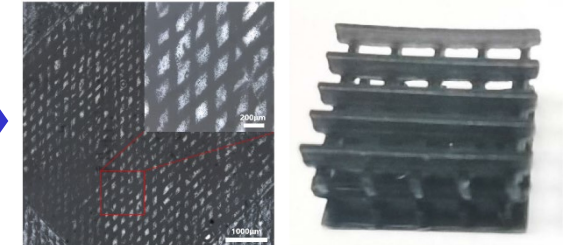


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Particle patterning



This study



Acoustic assisted 3D printing

We'd like to apply SAW methods to additive manufacturing!