JASMAC
Conference of the Japan Society of Microgravity Application

P09

音波浮遊法による無容器化学反応装置の開発

Development of containerless chemical reaction apparatus using sonic levitation method

廣瀬くるみ [1], 正木匡彦 [2]
Kurumi HIROSE[1], Masahiko MASAKI[2]
[1] 芝浦工業大学, Shibaura institute of technology #1,

1. Introduction

The acoustic levitation method is a method of levitating an object to a specific position without contact by acoustic radiation pressure due to standing waves [1)]. By levitating an object to a specific position without contact, it is possible to develop new materials regardless of the crucible material. Last year, we developed a sonic levitation system consisting of two transducer arrays with 37 transducers arranged on a concave surface, and succeeded in levitating a double droplet composed of water and silicone oil, as shown in Figure 1.

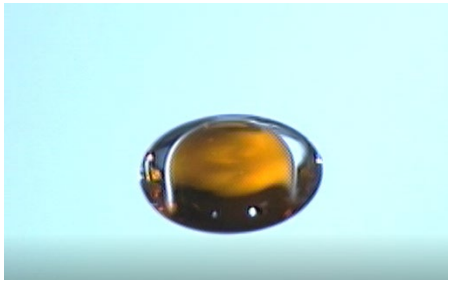

Figure 1. Double droplet (water droplet in the center)

In this study, a chemical reaction apparatus was fabricated to levitate and synthesize the droplets by sonic levitation, a containerless process. Furthermore, we plan to create double droplets using the fabricated apparatus.

2. Experimental Methods

2.1. Sonic levitation apparatus

The transducer array of the sonic levitation apparatus was fabricated using a 3D printer. the transducer array, which was placed vertically, was tilted about 14.7 degrees to synthesize two different materials in a non-contact state. a Murata MA40S4S ultrasonic transducer was used to generate 40 kHz ultrasonic waves. The focus of the transducer array was designed to be 93.5 mm, an integer multiple of the ultrasonic wave length of

8.5 mm. The nodes of the standing waves at the center of each overlap to enable synthesis. A 5 V square wave signal was sent from the function generator, boosted and converted to 15 V using a fabricated push-pull circuit, and all the oscillators were thereby driven in phase.

2.2. Fabrication of a push-pull circuit

One unit can drive two transducers; Sunhayato copper-clad laminate was cut and the electronic components were soldered. Figure 2 shows the circuit of one unit.

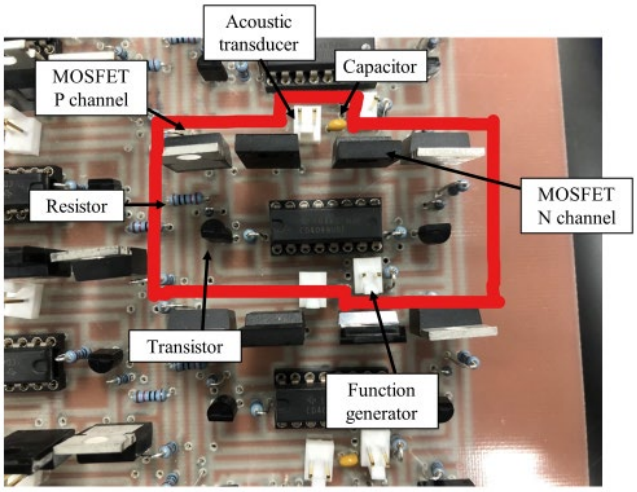

Figure 2. Push-pull circuit

3. Results

Two sets of sonic levitators were used, one set fixed and the other on a sliding board.

4. Conclusion

Simulations of the synthesis experiment were performed by levitating Styrofoam with a diameter of approximately 2 mm in two locations. The situation is shown in Figure 3. Styrofoam suspended in different locations successfully floated in one place. Therefore, synthesis is possible in principle.

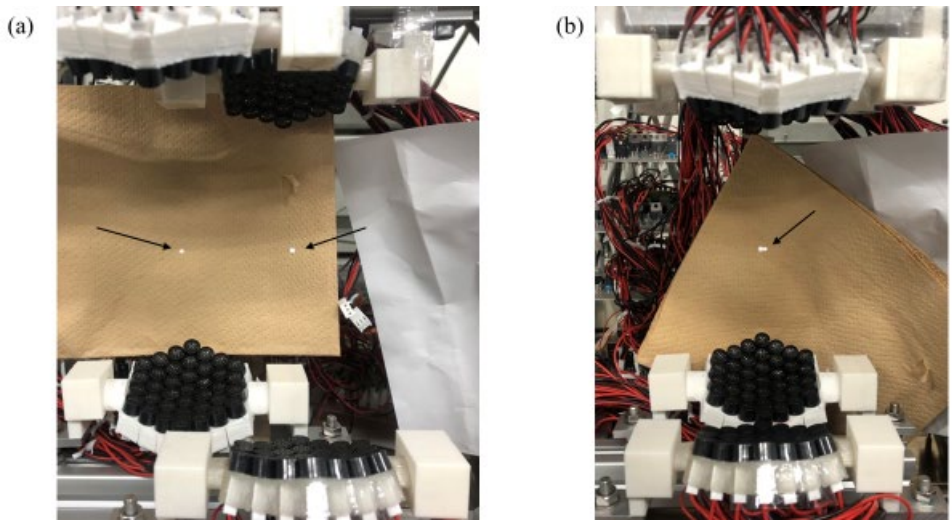

Figure 3. Experiments of non-contact synthesis. (a) Styrofoam suspended at different locations, (b) Styrofoam stability points overlap.

References

1) H. Hatano: Ultrasonic levitation and its application to containerless processing, Vol. 67, No. 3 (1998)A. Author 1, B. Author 2 and C. Author 3: Book Title, 2nd ed., Publisher (Year).