Gas-Liquid Two Phase Flow Behavior Related to ECLSS

● **Responsible Representative**

Hiroyuki Sugita, Research and Development Directorate, Research Unit II

● **Contact Information**

Masato Sakurai(sakurai.masato@jaxa.jp)

● **Members**

Shogo Chino, Gaku Murakami, Masato Sakurai

● **Abstract**

Elucidate the effects of gravity on gas-liquid two-phase flows to develop separation techniques for gas-liquid two-phase flows generated by the operation of the Environment Control and Life Support System (ECLSS).

● **Reasons and benefits of using JAXA Supercomputer System**

In order to evaluate the performance of gas-liquid separation technology, it is necessary to evaluate the microscopic physical phenomena of gas-liquid two-phase flows under microgravity. Large-scale and high-speed numerical simulations are essential for this study on Earth, and the vast computational resources provided by JSS are important.

● **Achievements of the Year**

In order to apply the capillary force-driven technology to gas-liquid separation technology, the case of impregnation of droplets into a model consisting of porous media with different wettability was investigated. As a result, it was found that unidirectional transport of droplets by capillary force is possible and that this transport capacity depends on the gas flow velocity into the system (Fig. 1, Fig. 2).
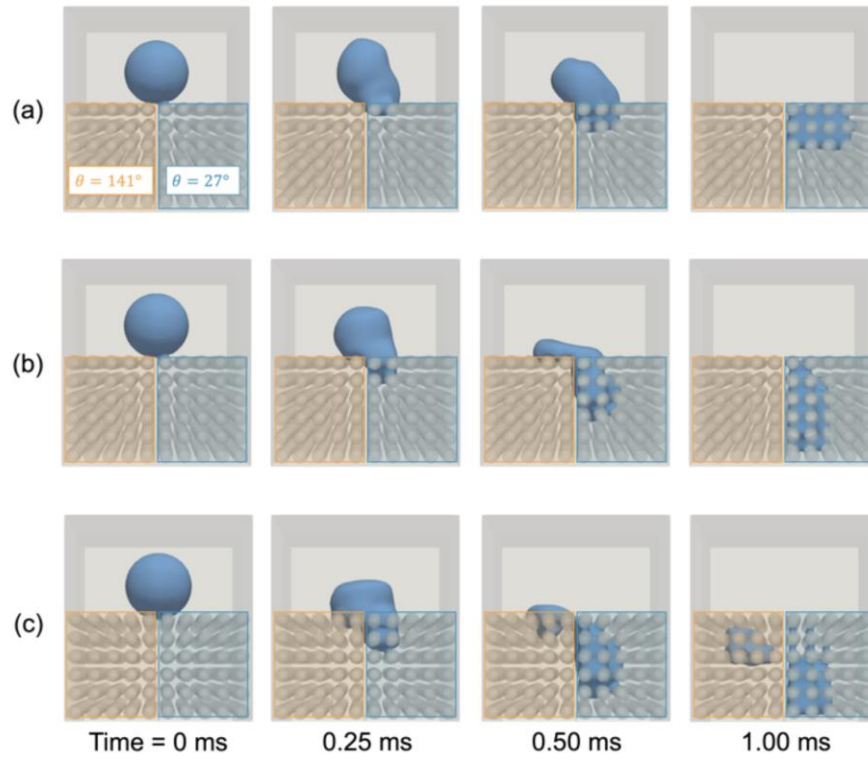
Fig. 1: Impregnation behavior on porous medium with wettability differences under Ugas = (a) 0 m/s, (b) 15 m/s, and (c) 20 m/s.
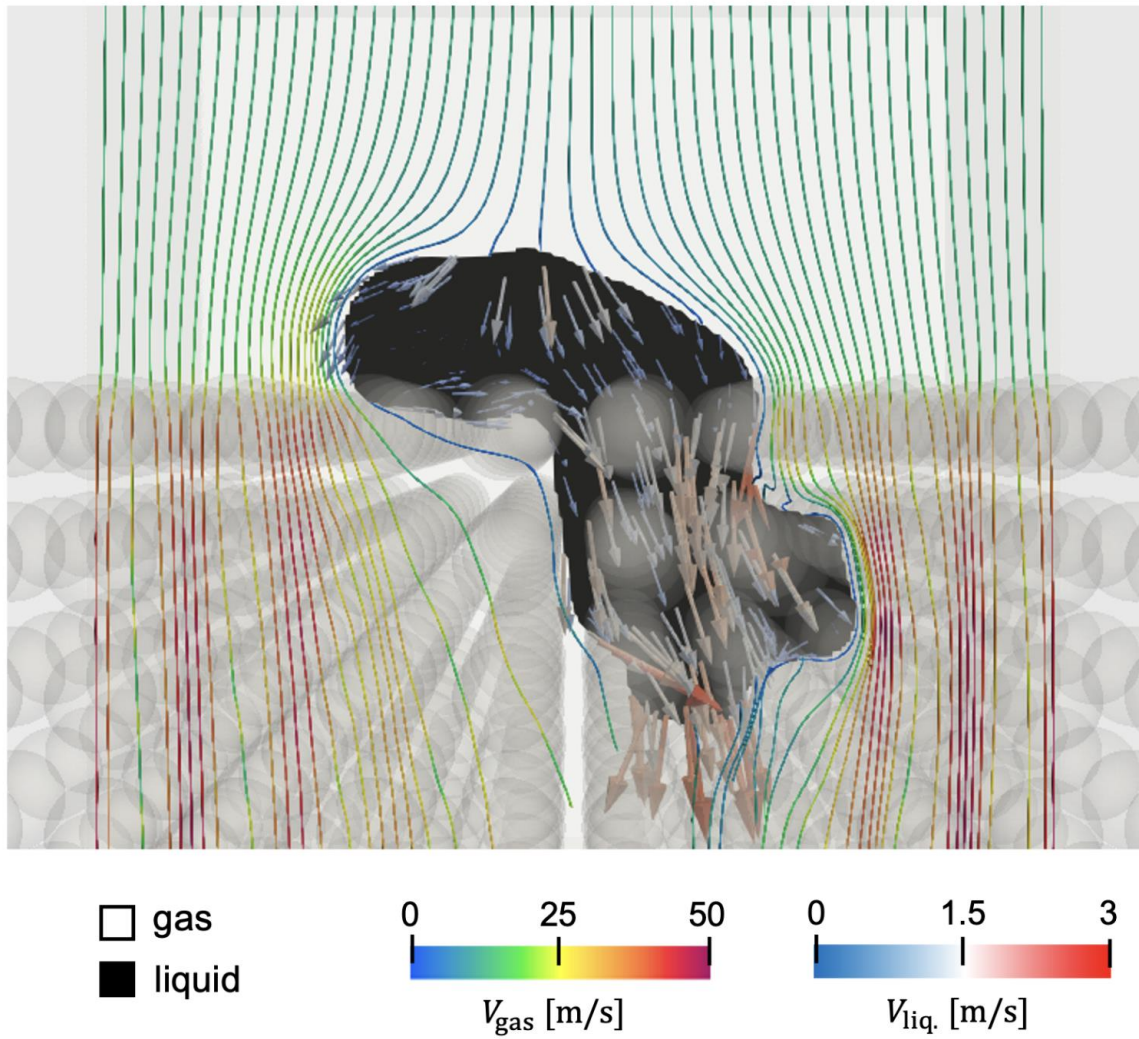
Fig. 2: Streamline distribution of gas and vector of liquid at Ugas =15 m/s (Time = 0.45 ms).

● Publications

- Poster Presentations

Numerical Analysis of Wettability-Controlled Gas-Liquid Separation Technology with Porous Medium, 66th Space Science and Technology Conference

● Usage of JSS

● Computational Information

Process Parallelization Methods	MPI
Thread Parallelization Methods	OpenMP
Number of Processes	144 - 324
Elapsed Time per Case	24 Hour(s)

● **JSS3 Resources Used**

Fraction of Usage in Total Resources[*1](%): 0.03

Details

Computational Resources		
System Name	CPU Resources Used (core x hours)	Fraction of Usage[*2](%)
TOKI-SORA	0.00	0.00
TOKI-ST	254,456.04	0.25
TOKI-GP	0.00	0.00
TOKI-XM	666.43	0.42
TOKI-LM	0.00	0.00
TOKI-TST	0.00	0.00
TOKI-TGP	0.00	0.00
TOKI-TLM	0.00	0.00

File System Resources		
File System Name	Storage Assigned (GiB)	Fraction of Usage[*2] (%)
/home	503.33	0.46
/data and /data2	30,753.33	0.24
/ssd	133.33	0.02

Archiver Resources		
Archiver Name	Storage Used (TiB)	Fraction of Usage[*2] (%)
J-SPACE	0.00	0.00

[*1]: Fraction of Usage in Total Resources: Weighted average of three resource types (Computing, File System, and Archiver).

[*2]: Fraction of Usage：Percentage of usage relative to each resource used in one year.

● **ISV Software Licenses Used**

ISV Software Licenses Resources		
	ISV Software Licenses Used (Hours)	Fraction of Usage[2] (%)
ISV Software Licenses (Total)	0.00	0.00

[2]: Fraction of Usage：Percentage of usage relative to each resource used in one year.

● **ISV Software Licenses Used**