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Introduction

- Natural processes such as volcanoes involve rising, splitting, and coalescing bubbles in magma.
- Jets of bubbles injected through a nozzle in liquid are common in various industries.
- Goal: process MRI images of bubbles in high-viscosity silicone oil with sesame seed percentages (0%, 10%, and 20%) to detect "regular coalescence".
- Image enhancement is required for better clarity of displayed bubble patterns.

Methods

- Experimental setup: 3D cylindrical system with 18 cm diameter, 38 cm height, and liquid filled up to 35 cm (Fig.1).
- Bubble generation: air injected vertically through a one-way valve
- Air injection: 700ms wait time, 160ms injection time
- MRI image processing using MATLAB: rotating, brightening, normalizing, and binarizing the images (Fig. 2).

Results

- 0% and 10% sesame seed mixtures showed no visible pattern of bubble formation
- 20% sesame seed mixture displayed a distinct pattern of bubble coalescence consistently every 5th frame as seen in Figure 3.

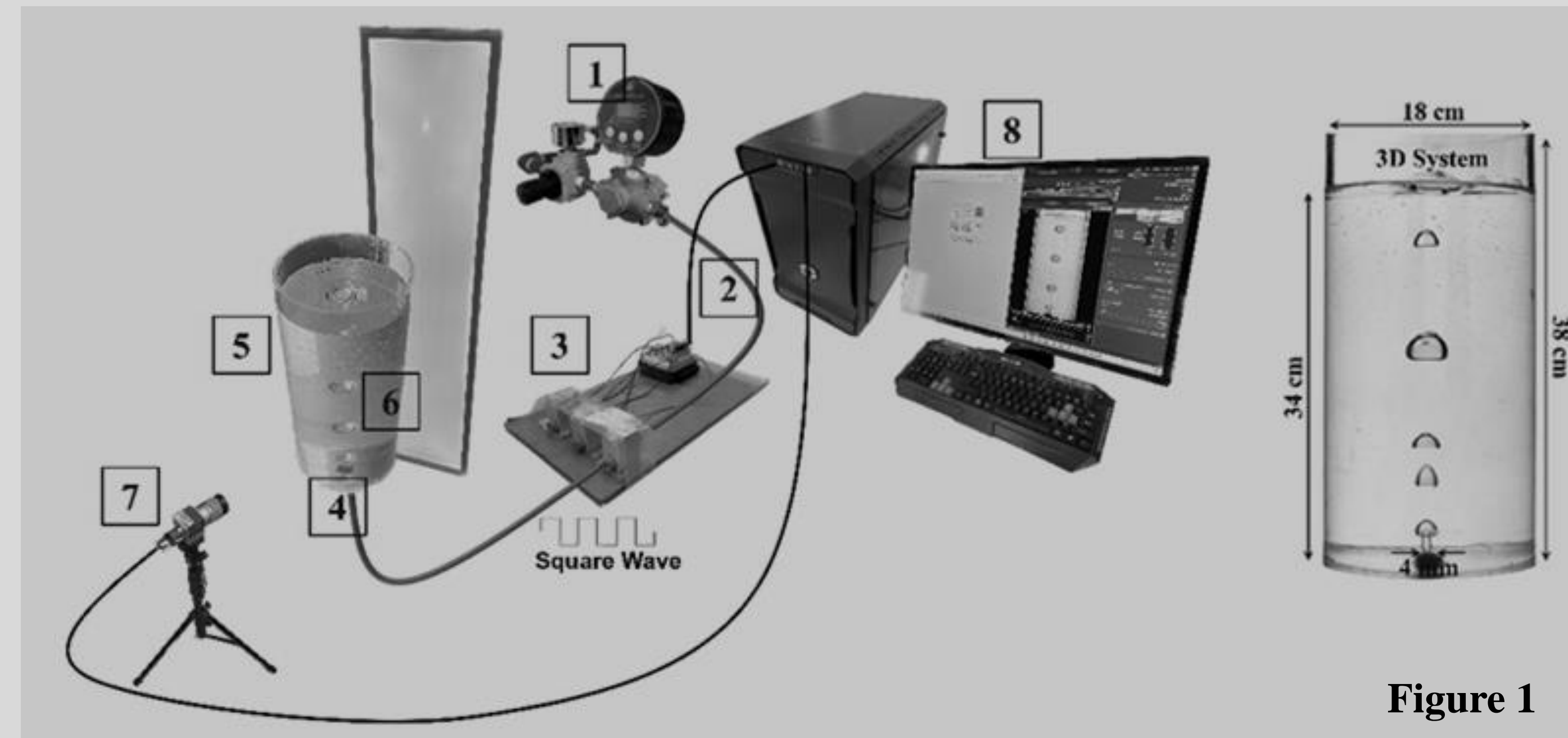


Figure 1

Conclusion

- MRI imaging and processing revealed a clear coalescence pattern in the 20% sesame seed mixture.
- Future studies: explore additional sesame seed percentages' effects on bubble formation patterns
- Investigate external factors like temperature and pressure variations may enhance the understanding of bubble dynamics in different environments.

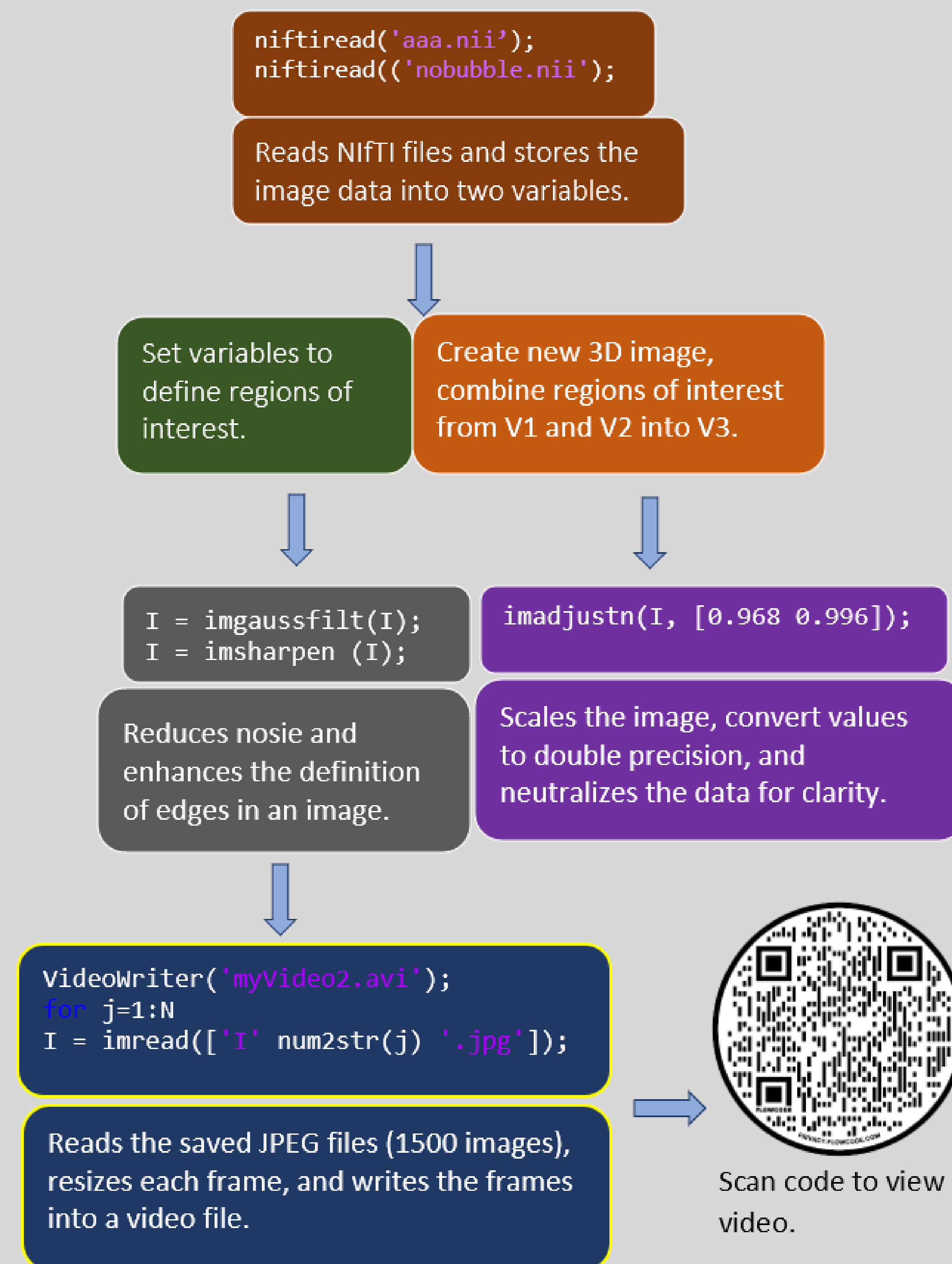


Figure 2

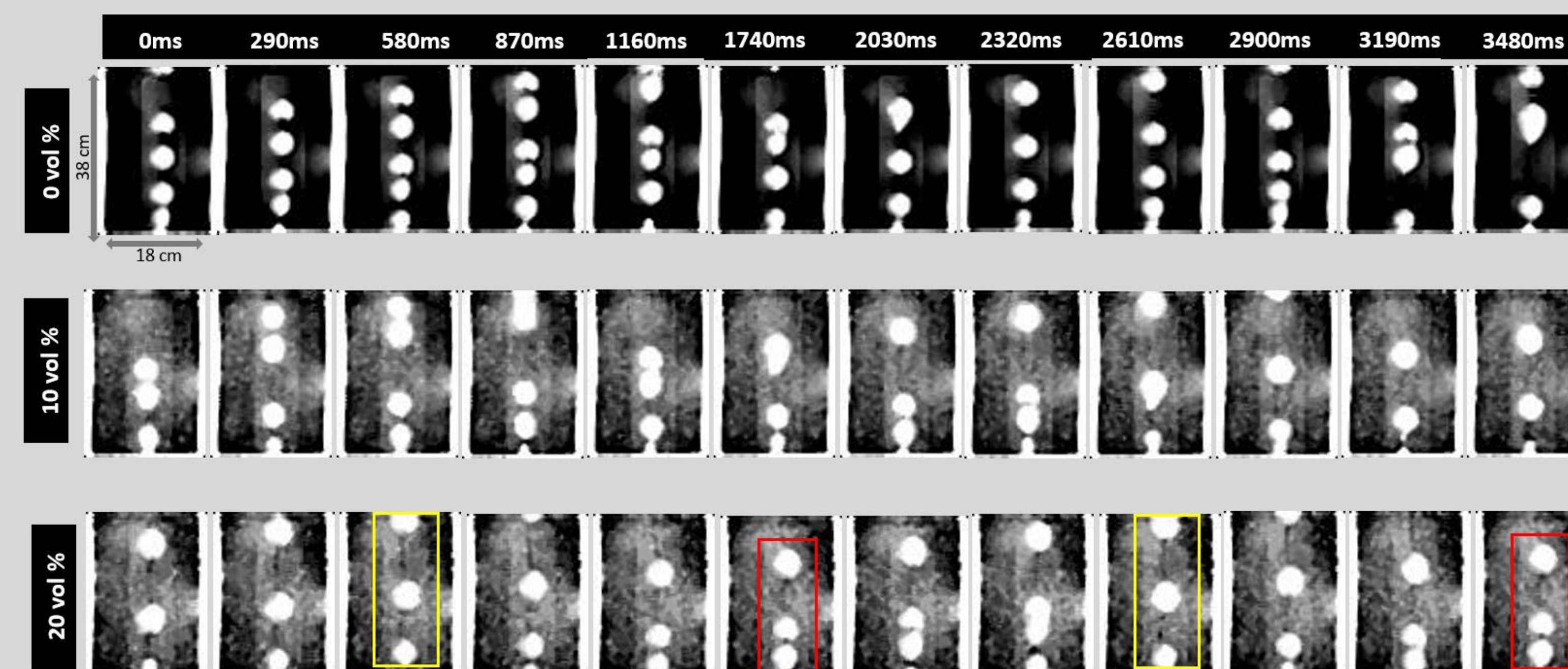


Figure 3

References

- A. W. Woods, *Turbulent Plumes in Nature*, *Annu. Rev. Fluid Mech.* 42, 391 (2010).
- M. C. Boufadel, S. Socolofsky, J. Katz, D. Yang, C. Daskiran, and W. Dewar, *A Review on Multiphase Underwater Jets and Plumes: Droplets, Hydrodynamics, and Chemistry*, *Rev. Geophys.* 58, e2020RG000703 (2020).
- S. R. Syeda and A. M. Ansery, *Formation and Development of Submerged Air Jets*, *J. Mech. Eng.* 44, 137 (2015).