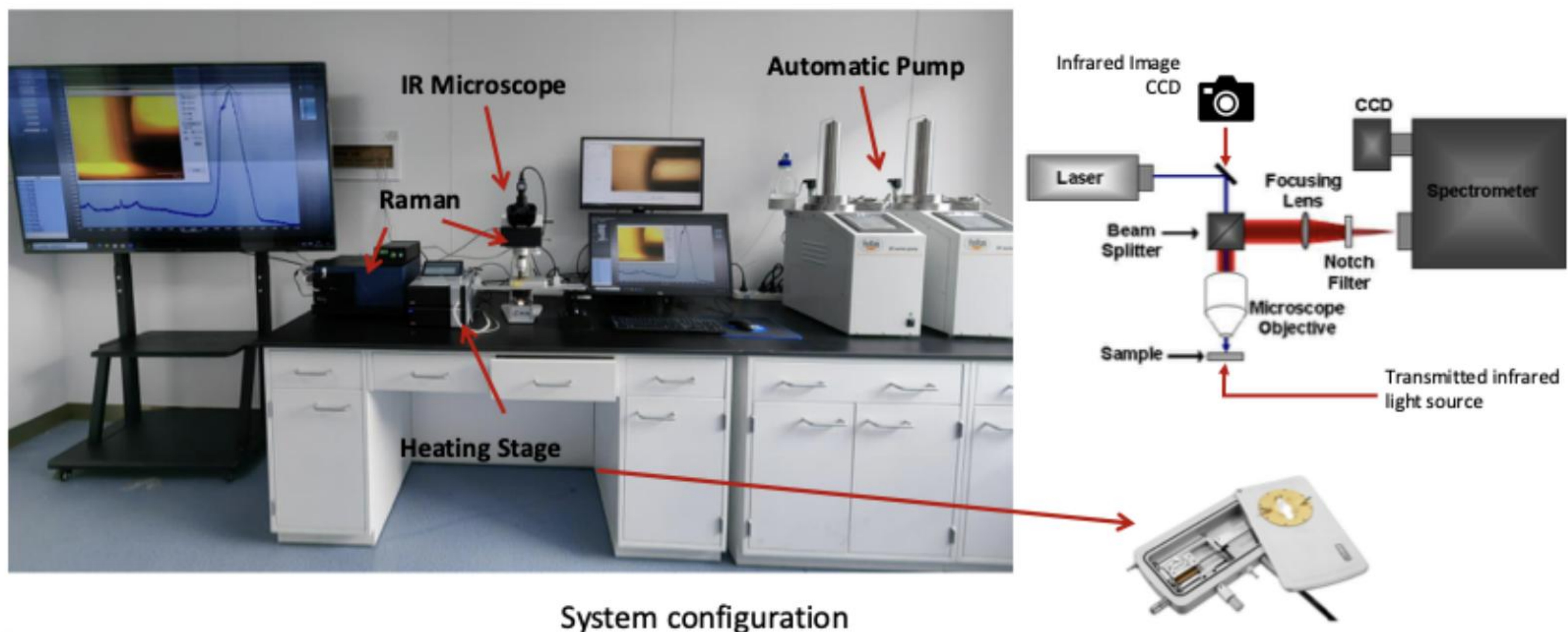


CRW AND COW System

In-situ Confocal Raman Microscope With HT/HP Control



Infrared Imaging High-Temperature and High-Pressure Visual Chamber Microscopic Raman CO_2 -Rock-Water (CRW) and CO_2 -Oil-Water (COW) Reaction System

The infrared imaging high-temperature and high-pressure visual chamber microscopic Raman oil-gas-water reaction system is an experimental platform that integrates multiple advanced technologies. It features high integration, real-time monitoring, high-temperature and high-pressure visualization, and high resolution. This system has broad application prospects in fields such as oil and gas exploration, development, and environmental protection, providing a powerful tool for the study of oil-gas-water reactions.

Key Benefit Features:

■ Infrared Imaging Microscope:

Infrared imaging technology utilizes the infrared radiation emitted by objects to create images, offering advantages such as non-contact measurement, long-distance detection, and real-time imaging. In this system, infrared imaging technology is used to monitor the interactions between oil/gas (particularly CO_2)/water under the temperature and pressure conditions inside the reaction chamber, enabling researchers to gain an intuitive understanding of the reaction process. Complete microscope observation functionality.

■ High-Temperature and High-Pressure Visual Chamber:

The high-pressure visual chamber is a transparent container capable of withstanding high-pressure environments, allowing researchers to directly observe the reaction process under high-pressure conditions. The transparent material used is silica capillary, which possesses excellent pressure resistance and light transmission properties. The high-pressure visual chamber provides the necessary physical conditions for oil-gas-water reactions, enabling researchers to conduct studies under conditions that more closely simulate real geological environments. Low environmental requirements, maintenance-free.

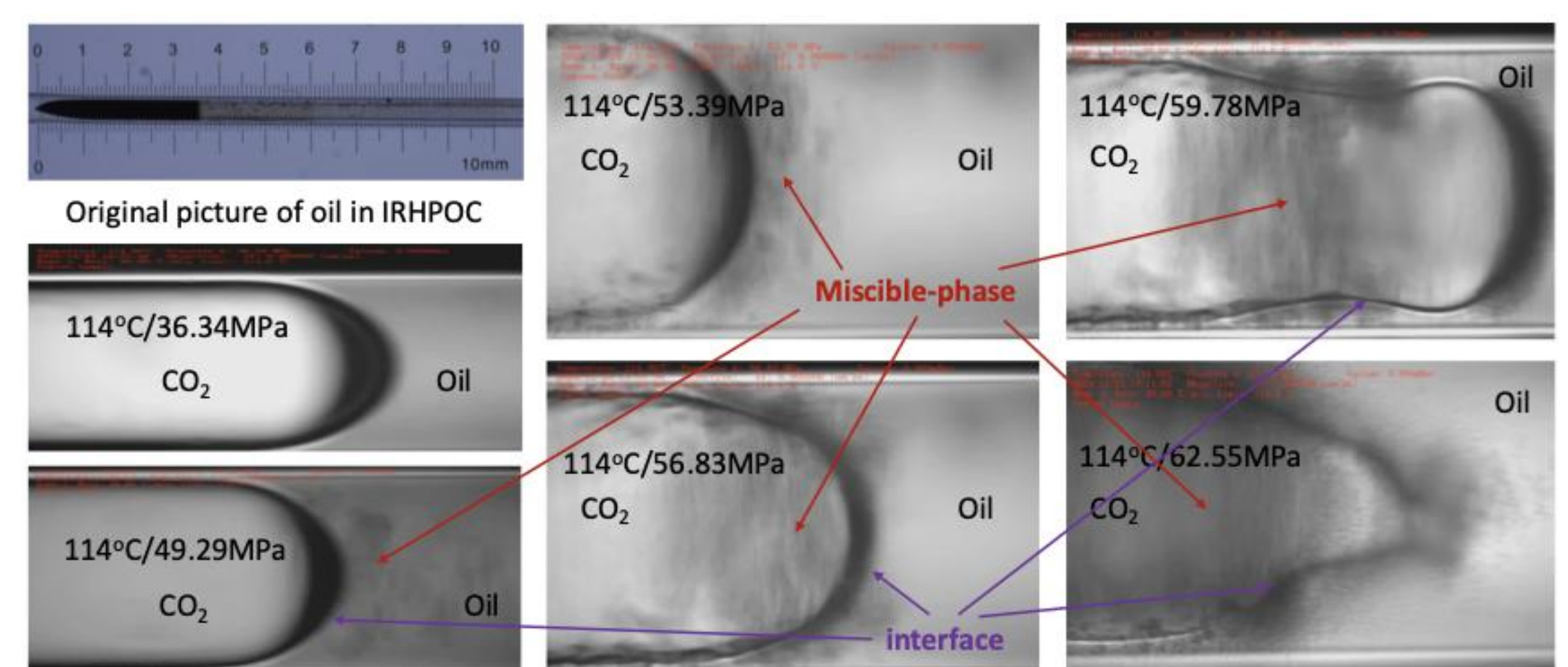


Fig.1 Interaction Pictures Between CO_2 and Oil Under Different Pressure

■ Microscopic Raman Spectroscopy:

Raman spectroscopy is a spectroscopic technique based on molecular vibrations, analyzing the molecular structure of substances by measuring the frequency shifts of scattered light. Microscopic Raman spectroscopy combines Raman spectroscopy with microscopy, enabling high-resolution analysis of the composition and structure of substances in microscopic regions. In this system, microscopic Raman spectroscopy is used to monitor the diffusion of gases in water, particularly the diffusion of CO_2 in saline aquifers, as well as the formation of new substances during CO_2 /water/rock reactions. This helps reveal the changes in CO_2 during carbon sequestration and uncovers the mechanisms and pathways of the reactions.

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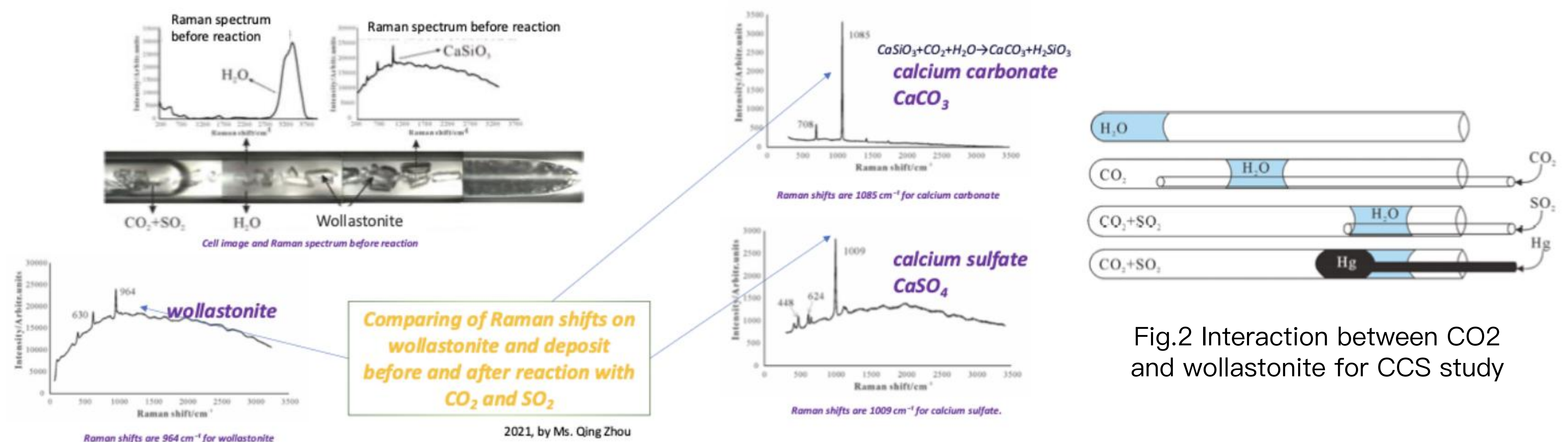


Fig.2 Interaction between CO₂ and wollastonite for CCS study

System configuration:

- ① 320mm focal length imaging spectrometer
- ② Equipped with confocal Raman probe boxes of wavelengths 532nm
- ③ Equipped with long working distance lens IR image microscopes with transmitted light/reflected light
- ④ IR image CCD
- ⑤ Automatic piston high pressure pump
- ⑥ High temperature heating stage

Key Benefit Features:

1. 320mm focal image spectrometer

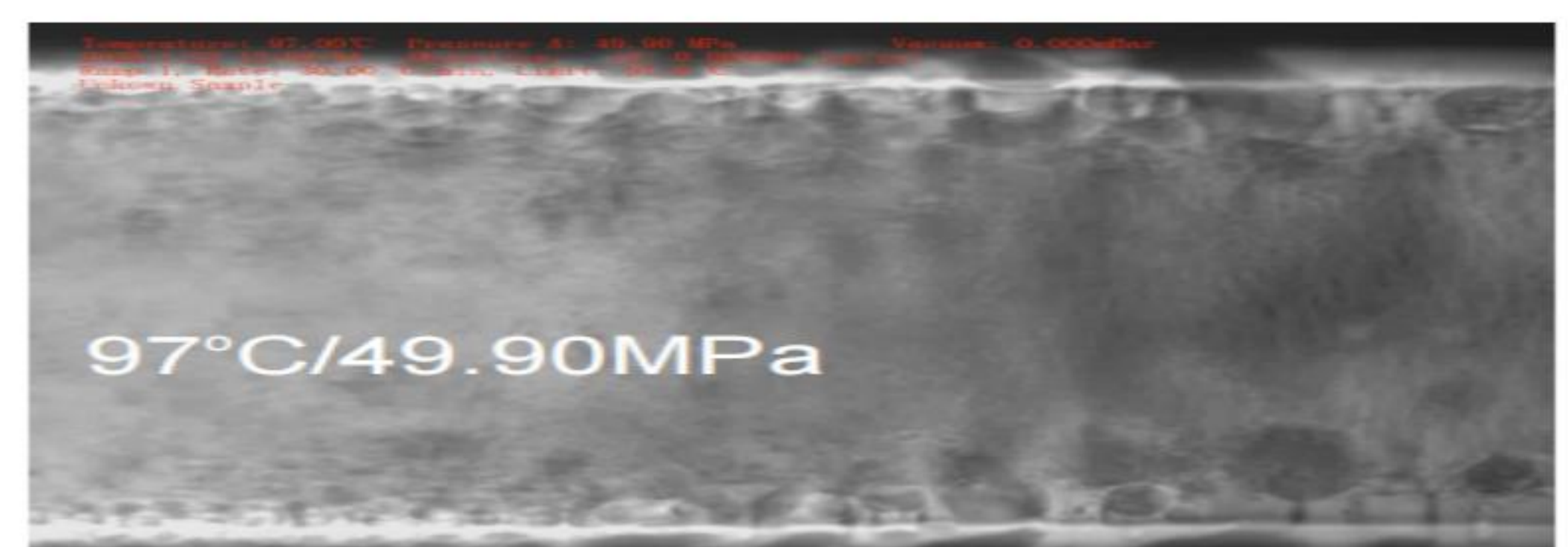
- ✓ Focal length: 320mm, F number F/4.1
- ✓ Manual slit, 0.01–3mm adjustable
- ✓ Single inlet slit, single outlet CCD interface
- ✓ Grating options: 1800g/mm, 600g/mm, 150g/mm (500nm shine)

2. 532nm Single integrated confocal Raman probe boxes

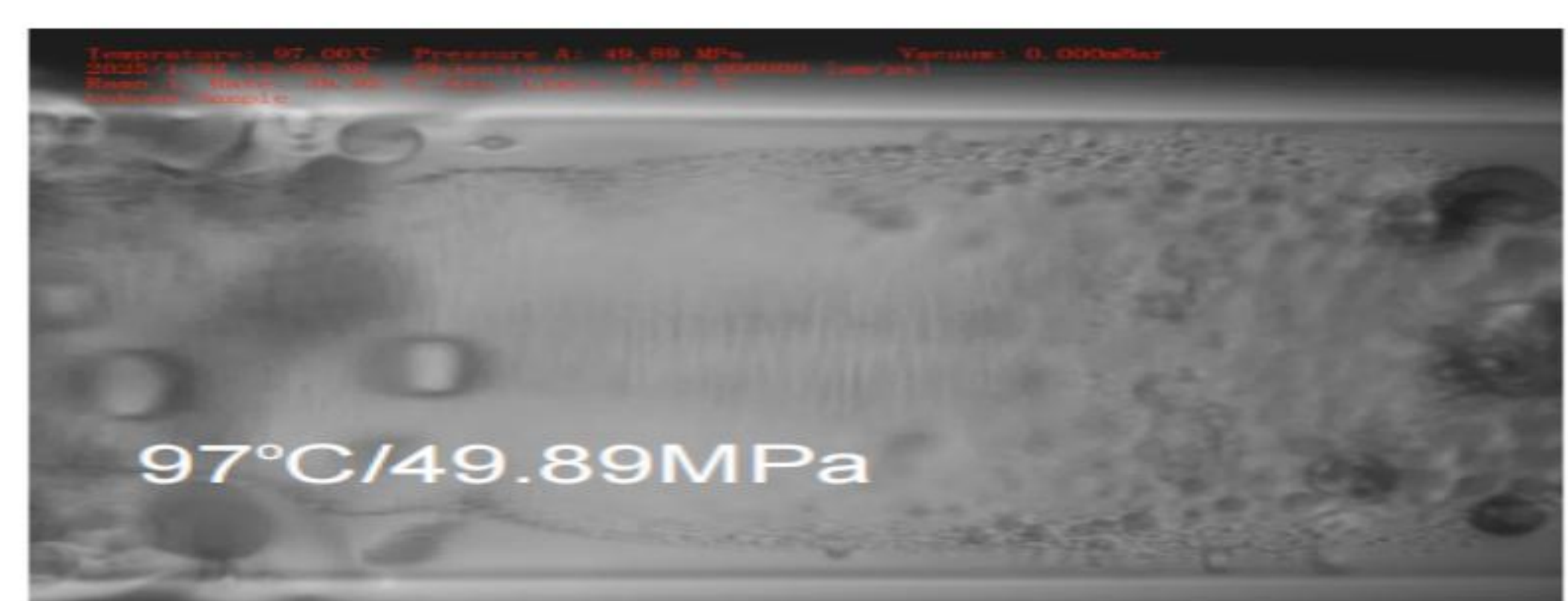
- ✓ Built-in solid state laser, power adjustable
- ✓ Spectral bandwidth: less than 1.5nm, long-term stability: less than 2%
- ✓ Microfocus fiber coupling
- ✓ SMA to SMA Optical Fiber jumper, <5m
- ✓ Microscope interface
- ✓ -60° deep refrigeration spectral CCD camera
- ✓ 2000x255 pixels, 15x15um pixel size, 30x3.8mm chip size

3. IR image microscope, compatible with heating state and pump

- ✓ Light Source: The top light source should be a broadband light source, while the bottom light source should be an infrared cold light source. Equipped with a filter block, inserting it enables infrared imaging, and removing it switches to visible light imaging.
- ✓ Objective Lens: Four options are available: 5X/0.1, 10X/0.3, 20X/0.45, and 50X/0.65 IR. The 20X and 50X objective lenses have adjustable silicon thickness penetration (0–1.2 mm).
- ✓ Eyepiece: The eyepiece is a standard 10X22 field of view eyepiece.
- ✓ CCD Camera: Infrared imaging camera.
- ✓ CTV: U-TV1XC interface.



INTERACTION BETWEEN CHEMICAL OIL AND CO₂



4. Heating state and pump

- ✓ Temperature range: -195 to 500°C
- ✓ Accuracy: 0.1°C
- ✓ Pressure range: up to 150MPa
- ✓ Accuracy: 0.1% FS

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