

Pilot test for microbubble CO₂ injection to reservoir in oil field - results and estimation -

*Ryo Ueda¹, Masanori Nakano¹, Ziqiu Xue²

1. Japan Petroleum exploration CO.,LTD., 2. Research Institute of Innovative Technology for the Earth

In this study we have worked toward practical use of microbubble CO₂ injection technology to CCS and CCUS. We have studied the effects of microbubble CO₂ injection to CO₂ storage in reservoir and their mechanism through the laboratory experiments which was core flooding test and flow simulation. This year field pilot test for the estimation of microbubble injection technology was performed in a part of domestic oil field.

Sarukawa oil field in Akita, Japan was selected as test field. This field has multi-layered reservoir consisted of sand and mud stone and high heterogeneity to vertical direction. Depth of reservoir is about 900m and CO₂ is supercritical in reservoir condition. Huff' n Puff method was applied to this field test. Flow rate, cumulative volume, well head and bottom hole pressure were measured during CO₂ injection for 10 days and flow back (fluid production) for 7 days. From microbubble and normal CO₂ injection test the application of microbubble tools and injection technology in field were estimated.

Microbubble tools were designed that it is set on the end of tubing pipe and retrievable with slick line or wire line unit and microbubble is formed in bottom hole in terms of economic efficiency and convenience in practical use and applied to this field. In this field test utility of microbubble tools, which was retrievable easily and was able to form and inject microbubble stably was evaluated.

In term of the effect of microbubble injection, Average CO₂ injection rate was 2.1t/D and cumulative CO₂ injection volume for 10 days was 20.1t in microbubble injection test and 0.56t/D and 5.8t in normal injection test respectively. CO₂ injectivity was 0.39t/D/MPa in microbubble injection and 0.09t/D/MPa in normal injection and improvement of CO₂ injectivity in microbubble injection was indicated compared with normal injection. Ratio of CO₂ storage to CO₂ injection volume was 80.2% in microbubble injection and 62.5% in normal injection and improvement of CO₂ storage in microbubble injection was indicated.

Acknowledgements

This presentation is based on results obtained from a project commissioned by the New Energy and Industrial Technology Development Organization (NEDO) and the New Energy the Ministry of Economy, Trade and Industry (METI) and attributed to basic study for micro bubble CO₂ injection technology by Tokyo-gas Co., Ltd. and RITE. We deeply appreciate them.

Keywords: Geological CO₂ Storage, microbubble, field test