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Editorial: Advances in wellbore servicing fluids and materials

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Editorial on the Research Topic
Advances in wellbore servicing fluids and materials

Introduction

Advances in wellbore servicing fluids and materials

Wellbore servicing fluids play an essential role during the exploration and development of oil and gas resources, especially during the construction of a wellbore. Nowadays, as we are drilling deeper and exploring unconventional depositional environments, the wellbore servicing fluids come across extreme conditions regarding reservoir pressure, temperature and corrosive gases like CO_2 and H_2S, which brings significant challenges to the current wellbore servicing fluids (Bu et al., 2016; Guo et al., 2020; Liu et al., 2021; Pang et al., 2021).

The utilization of advanced polymeric and composite materials as wellbore servicing fluids and additives becomes an emerging trend to deal with these new challenges (Bu et al., 2017; Du et al., 2019; Bu et al., 2021; Wang et al., 2022). The overall goal of this Research Topic is to encourage the exploration of polymeric and composite materials for use as wellbore servicing fluid, to promote the development of wellbore servicing fluid technology, and to improve the efficiency of petroleum exploration and hydrocarbon extraction.

This "Advances in Wellbore Servicing Fluids and Materials" Research Topic aims at including original research articles on the advances in scientific research, materials, technologies, and processes related to drilling fluid, completion fluid, kill fluid, workover fluid, and fracturing fluid. A total of five articles are collected, which presented advances in theory, experiment, simulation and methodology with applications to compelling problems:

Chen et al., employed the micro-sized magnesium oxide in oil well cement to prevent the chemical shrinkage of cement sheath. Their study helps readers to improve the understanding of the effects of micro-sized magnesium oxide on the rheological properties and compressive strength of oil well cement at different temperatures. The developed cement slurries show great potential to mitigate the degradation in bonding strength between cement sheath and casing string.

Bu et al., used an advanced simulation technology to study the effects of the elastic modulus and Poisson's ratio of the cement sheath on the maximum tensile and compressive stresses of the cement sheath under fracturing pressure. Their study provides new insights for the determination of the integrity failure of the cement sheath during the shale gas fracturing.

Qin et al., applied a comprehensive quantitative X-ray diffraction (XRD) analysis on silica-enriched oil well cement, which were cured under the condition of 200°C and 50 MPa with a maximum duration of 180 days, to probe the driving force of cement long-term strength retrogression. Three different quantitative Rietveld methods for XRD analysis were used to study the crystal phase change in set cement. Their study advances our understanding in terms of the controlling mechanism of long-term strength retrogression of silica-enriched Portland cement systems under high temperatures.

Sun et al., monitored the heat release of oil well cement hydration in the temperature range between 5°C and 30°C by isothermal calorimetry. They evaluated the dependence of apparent activation energy on curing temperature, cement source, w/c ratio and addition of $CaCl_2$ and proposed an advanced scale factor model to predict the effect of low temperatures on the hydration heat evolution of oil well cement.

Bai et al., studied the setting dynamics behaviour of particle clusters by using the CFD-DEM method. The dispersion of particle clusters is highly relevant to the carrying capacity of service fluids, such as fracturing fluid and drilling fluid. They adopted an interesting simplified model to quantitatively characterize the settlement behaviour of mixed-fibre clusters from a macroscopic perspective.

The Guest Editorial team wish that this Research Topic will be the foundation of an international network for scholars to exchange relevant advances on the materials, theories, experiments, processes, products, methods, technologies, and achievements in the field of the wellbore servicing fluids used in unconventional depositional environments, which can be a starting point for future discussion and collaborations.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

AS was empolyed by the Aramco Services Company.

The remaining authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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