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Perspective

Industrial Applications of Graphene-Based Membrane Technology

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DESCRIPTION

Some people working in oil and gas exploration and production have undoubtedly been inspired by the "nano" information they have learned so far in other industries. Over the past two decades, efforts have been made to convey this knowledge to the oil and gas business. Promising findings have been obtained from ongoing research into the use of nanomaterials to address a variety of problems that arise during oil and gas exploration.

The use of nanomaterial-based sensors for reservoir monitoring and surveillance is nanotechnology for the Enhanced Oil Recovery (EOR) process, and reducing the environmental impact of the oil industry are among the research areas worth highlighting. Despite progress, there is still plenty to strive for and accomplish. In order to support their prospective use in oil recovery procedures, a review of the development of graphene-based membranes will be made in particular.

In order to mobilize, displace, and produce the greatest amount of hydrocarbon possible, Improved Oil Recovery (IOR) and Enhanced Oil Recovery (EOR) techniques are based on research of fluid behaviour at macro and microscales. In order to achieve this, the industry has been researching the potential of Low Salinity Water Injection (LSWI), a technique that involves injecting appropriately modified, filtered water while adhering to a predetermined protocol to maximize displacement at both macro and micro scales. Long-term use of graphene membranes in the oil sector is regarded as a unique technology. However, the scientific and technical communities are already hard at work on a number of graphene membrane applications in other disciplines. Desalination of water for a variety of uses is one of these applications.

Polymeric membranes have developed a significant role in desalination and other separation disciplines, and they are now often utilized in micro and ultrafiltration. A membrane is just a distinct, thin interface that controls how easily chemical species come into contact with it. This interface may be chemically or physically heterogeneous, for example, comprising holes or pores of limited dimension or consisting of some type of layered structure, or it may be molecularly homogeneous, that is, fully uniform in composition and structure.

The transport rate of a species across anisotropic membranes is negatively correlated with membrane thickness. In separation procedures, high transport rates across membranes are highly desirable for financial reasons. Therefore, it is best if the membranes are as thin as feasible.

Anisotropic membranes are made up of an incredibly thin layer on top of a thicker porous substrate because conventional film manufacturing techniques can only produce mechanically stable, defect-free films down to roughly 20 m in thickness. While the porous support just serves as a mechanical substrate, the penetration rates and separation properties of the membrane are solely dependent on this surface layer and its substructure.

Membranes function as semipermeable barriers that let some species (such as water) pass swiftly while obstructing or totally preventing the passage of others like salts and other contaminants. The current gold standard for desalination and other high-end applications of membrane technology is thin-film composite membranes with active layers constructed of polyamide with a thickness of roughly 100nm–300nm and marked by considerable roughness. Because of its high mechanical strength and atomic thickness, graphene is a great starting material for creating size-selective membranes, which explains the increased interest in the mass transport characteristics of graphene-based membranes. Modern-day production of graphene membranes includes both single-layer and multilayer stacks.

CONCLUSION

The wide range of ongoing investigations is validated out of which the development of graphene-based membranes for desalination separation stands out for a variety of reasons, including: The use of such membranes in the desalination process would prove crucial in the "manipulation" of injection water for LSWI. GO membranes are inexpensive, and the preparation process is relatively simple, while the more difficult

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preparation process for NPG membranes could be compensated. Experiments on the subject have shown that the presence of stacked Graphene Oxide (GO) flakes or Nanoporous Graphene (NPG) can further enhance the filtration properties of the support membrane. Additionally, the knowledge gained from the Proof of Concept (PoC) provides a chance to lay the groundwork for an oil recovery technology that could help mature fields live longer than their economic capacity.