Joule heated sorbent design enables faster cleanup of viscous crude-oil spill

Subject Code: E02

With the support by the National Natural Science Foundation of China, a research team led by Prof. Yu Shuhong (**俞书宏**) from the University of Science and Technology of China made a breakthrough in the cleanup of viscous crude-oil spill. Their team for the first time realized the fast absorption of high viscous crude-oil from water surface by introducing joule-heating effect to porous hydrophobic and oleophilic sorbents (PHOM), which was published in *Nature Nanotechnology* (2017, 12: 434—440. Front Cover). This work was highlighted by *Nature*, and was featured in the *News & Views* and Editorial of *Nature Nanotechnology*.

Oil spill accidents not only cause huge loss of energy resources, but also bring long-damage to marine ecosystems. The marine oil spills usually have the features of large area, low thickness, high viscosity, and so on, which make it a challenge to be cleaned up. Recently, PHOM has been demonstrated as a promising candidate for the cheanup of oil spills. However, PHOM will gradually lose its effectiveness when the oil viscosity increases, which prevents their wide application in real ocean crude-oil spills.

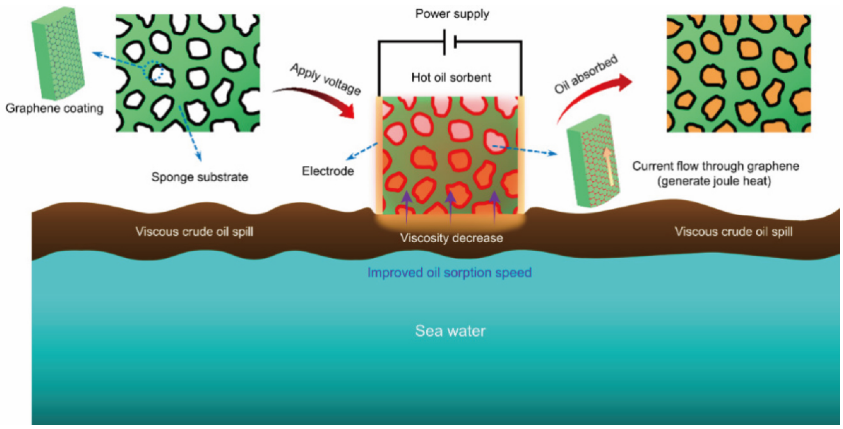

Figure Schematic illustration of using joule heated graphene wrapped sponge to cleanup viscous crude-oil spill.

To solve the above problem, Yu's team prepared a graphene wrapped sponge (GWS) which has a collective property of hydrophobicity and electrical conductivity. When the graphene wrapped sponge is put on the viscous crude-oil spill and applied with an electric current, the heat generated from the graphene coating of the sponge will heat up surrounding crude-oil. Because of the temperature increase, the crude oil becomes thinner and passes through the pores into the graphene wrapped sponge quickly (as illustrated in the figure). They further optimized the heat-utilization efficiency, and put forward a confined heating design for joule heated GWS, which not only saved 65.6% of electric energy but also decreased consumption of graphene oxide by 50%. In addition, the oil sorption time was decreased by 94.6% compared with GWS without the aid of joule heating. To demonstrate the large-scale application of this joule-heated GWS, we also proposed a dense electrodes design, which could homogeneously heat up large-size GWS to a high temperature at a low applied voltage.

This research initiates a new era of sorbent design for the high-speed cleanup of real crude-oil spill. We believe this joule-heated sorbent design will find wide application in the remediation of future marine oil spill accidents after further optimization of this joule heated sorbent design.