Occurrence of movable organic matter in clay-sized fraction of shale: Evidence from the relationships between organic carbon and specific surface areas

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Organic matter (OM) in shale has a variety of forms and varies in physicochemical properties, which is mainly occurred as free and mineral-combined states and has great variations in the stability (or movability) of occurrence in geologic body. This will induce the difference of hydrocarbon generation and migration in source rocks.

Mineral surface is the principal place for the organic-inorganic interaction, and is of critical importance for the OM occurrence. As clay-sized minerals are the main carrier of OM occurrence and the major contributor to specific surface areas (SSAs), clay-sized fractions (<2μm) separated from shales were selected to be the object of this study. Clay-sized fractions were physically and chemically treated with different reagents and performed the measurements of pyrolysis, SSA and FTIR to discuss the difference of *in situ* occurrence stability of OM in the shale. Results reveal that the total organic carbon (TOC) in clay-sized fraction can be categorized into physical movable-OC (PmOC), chemical movable-OC (CmOC) and stable-OC (SOC), which account in TOC for 43.3%, 17.1% and 39.6%, respectively. OM in clay-sized fraction mainly occurs on the mineral internal surface, but the occurrence sites of the different movable OM are variable: the PmOC is mainly occurred in the pores induced by the minerals and at the mouth and/or edge of the interlayer domain of clay minerals; the CmOC is chiefly occurred on the mineral external surface; and the SOC is mainly occurred on the mineral internal surface. This investigation on the movability of OM in clay-sized fraction can further detail the study on the OM occurrence in shales and is unequivocal in understanding the practical significance for petroleum exploitation which the occurrence of different OM makes, and provides guiding significance for the petroleum exploration and exploitation, particularly in unconventional petroleum systems.