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Cryogenic fracture behaviour of Indian Gondwana shale- A laboratory study

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Shale is an unconventional source of natural oil and gas which due to the lack of proper technological advancement could not come to the lime light until the recent use of hydraulic fracturing and directional drilling. With the growing energy demand every nation is eyeing towards the development of more profiting as well environment friendly ways of energy production. Shale gas being mainly composed of methane produces far less amount of carbon dioxide as compared to combustion of coal. Shale being a very low permeable rock, needs to be fractured to enhance the flow of the contained gas. Currently shale gas is mainly produced by hydraulic fracturing of the tight shale formations using water but the major problem associated with this is the voluminous amount of water required and the management of the contaminated flow back water.

The fracture behaviour of shale varies with the amount of associated mineral matter, in-situ temperature and pressure as well as the degree of compaction the shale has gone through. The fracture generation and its controlled migration is a crucial point to understand for maximum production of gases. The shifting of failure mode from brittle to ductile mode controls the long term flow behaviour of fluid through them. This technology has not yet been fully utilized in India due to the lack of understanding of hydraulic fracturing as well as because of the unavailability of sufficient amount of water. To overcome this problem with water availability USA, Canada and China have attempted alternative tools and techniques.

In this paper an attempt has been made to understand the fracture behaviour of Gondwana shale from coal measure rocks which doesn't have any detailed study so far in Indian context. The laboratory investigation is carried out using liquid Nitrogen as a fracking agent. The selected shale block was collected from the study area. In the central part of the block a core of 50mm diameter was drilled and liquid nitrogen was filled as a fracturing media. The result produced seems promising at a laboratory scale and can be carried forward to a field scale. Another benefit of using this method is that this is environment friendly as there is no concern over contaminated flow back water.