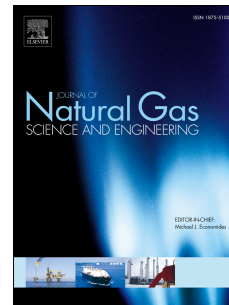


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Known and to be known

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Review on formation damage mechanisms and processes in shale gas reservoir: known and to be known

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Abstract

Producing natural gas from shale gas reservoir presents a great challenge to petroleum industry due to its low permeability nature. The process of gas release and production from shale reservoirs is controlled by the combination of fractures and nano-pore network connected to micrometer pore network. However, the gas production after drill-in, completion and hydraulic fracturing are strongly influenced by formation damage and subsequent decrease of reservoir permeability and fracture conductivity. This paper reviews the main formation damage mechanisms during shale gas reservoir exploitation, including the physical and chemical damage. Formation damage types induced in drill-in, completion and stimulation processes are discussed in detail. Finally, the systematic evaluation method of formation damage, heat treatment and working fluid loss control, as three further research directions for formation damage control and removal are proposed for the efficient development of shale gas reservoirs.

Key words: shale gas reservoir; formation damage; physical and chemical damage; drill-in and completion; reservoir stimulation; working fluid loss

1. Introduction

Formation damage is an undesirable operational problem that can occur during gas and oil recovery from reservoirs in different stages, including drilling, completion, production, hydraulic fracturing, and workover operations (Bennion, 2002; Civan, 2007; Lv et al., 2010). Formation damage is a hot topic nowadays as more operating companies move to the exploitation of more challenging gas and oil reservoirs in tighter, deeper, and more depleted conditions. Disappointing production or injection results from gas or oil wells can be related to a number of factors which are difficult to diagnose. Some of these factors may center about poor inherent natural reservoir quality characteristics, others about mechanical considerations according to the condition and type of

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