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Xiaodong Hu, Xianzhi Song, Gensheng Li, Zhonghou Shen, Zehao Lyu, Yu Shi



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## Shape factor of the flake-like particle in thermal spallation and its effects on settling and transport behavior in drilling annulus

Xiaodong Hu, Xianzhi Song\*, Gensheng Li, Zhonghou Shen, Zehao Lyu, Yu Shi

<sup>a</sup> China University of Petroleum, Beijing, China

Corresponding author: Xianzhi Song

Email: songxz@cup.edu.cn

### Abstract

Thermal Spallation Drilling (TSD) is widely applied in the exploration and development of oil, gas, and geothermal resources. Flake-like spalls (or particles) are often created during the TSD process. Our study in this paper focused on shape factor of flake-like spall in thermal spallation and its effects on settling and transport behavior. First, we conducted thermal spallation experiment and collected spalls. The shape factor of spall was obtained. The spalls with the shape factor in the range of 0.6 to 0.7 occupy the largest percentage. Based on that, a settling velocity model of single spall was obtained. We verified the model by comparison with the settling experiment results. After that, we investigated the effects of fluid and spalls properties on settling velocity. Finally, the effects of shape factor on spalls transport in drilling annulus were clarified by numerical simulation. In vertical section, when the shape factor is smaller, spalls can transport for longer distance and the spall distribution is more uniform. In the horizontal section, with the decrease of shape factor, the spalls have a longer transport length and lower spalls bed. All these results can be used for the optimization of drilling fluid.

**Keywords:** Multi-phase flow; Thermal spallation; Spalls; Settling velocity; Shape factor

### 1. Introduction

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