UNIVERSITI TEKNOLOGI MARA

CHARACTERISTIC STUDY OF GRAPHENE OXIDE (GO) COATED SAND PROPPANT

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ABSTRACT

Hydraulic fracturing is a well stimulation method performed on reservoirs with low permeability to improve the flow of hydrocarbon into wellbore. Certain chemicals are injected into the well under very high pressure; propping agent, such as sand is added to the fracturing fluid to keep the fracture open. In order to study the performance of coated sand used in application of hydraulic fracturing, local sands are improved by surface modification using Graphene Oxide (GO) as the coating agent. The interaction of GO and sand are confirmed through Fourier-Transform Infrared (FT-IR) and Scanning Electronic Microscopy (SEM). The image of SEM showed that the coating of GO had modified the uneven/rough surface of uncoated sand. In order to study the performance of GO sand proppant, a series of laboratory tests were performed according to the recommended practice International Standard Organization (ISO13503-2) and American Petroleum Institute (API 19C). The roundness and sphericity, acid solubility, crush resistance and grain size were measured for all samples. The results of sphericity and roundness showed that only Sample 4 satisfied the standard requirement. Acid solubility of Sample 4, 5, 6, 7, and 8 have met the API requirement. The turbidity values for all samples are varied from 21-80 FTU, agreed with the ISO recommended. GO coated sand have a potential characteristic as a proppant. GO can be used to smooth the surface of uncoated sand, improve the strength, decreased the solubility acid of sand and make it more desirable as proppant.

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TABLE OF CONTENT

	Page
AUTHOR'S DECLARATION	**ii**
ABSTRACT	**iii**
ACKNOWLEDGEMENT	**iv**
TABLE OF CONTENT	**v**
LISTOF TABLE	**viii**
LIST OF FIGURE	**ix**
LIST OF EQUATION	**x**
LIST OF ABBREVIATION	**xi**
CHAPTER ONE: INTRODUCTION	
1.1 Research Background	1
1.2 Problem Statement	2
1.3 Research Objective	3
1.4 Scope Of Work	3
CHAPTER TWO: LITERATURE REVIEW	
2.1 Hydraulic Fracturing	4
2.2 Proppant Agent	4
2.2.1 Type of proppant	4
2.2.1.1 Sand (frac sand/silica sand)	5
2.2.1.2 Ceramic proppant	6
2.2.1.3 Resin coated proppant	6
2.2.1.4 Lightweight proppant	7
2.2.2 Properties and Quality Proppant Testing	7
2.2.2.1 Proppant Size	7
2.2.2.2 Shape	8
2.2.2.3 Acid Solubility	10
2.2.2.4 Turbidity	10

CHAPTER ONE
INTRODUCTION

1.1 Research Background

Stimulation techniques are commonly applied to encourage production to flow from the reservoir rock. Today, hydraulic fracturing is commonly used to stimulate the flow of natural oil and gas by producing fractures in the rock formation. During fracturing process, fracturing fluid is injected at high pressure to break down the rock. The proppant agent is used to keep the fracture to open, resulting the improvement of production. There are many materials have been used as proppant agent such as natural sand, glass, resin coated sand, walnut hull and fused zirconia (Liang et al., 2011).

In 1947, the first fracturing operation was done using 20,000 lbs of uncoated fracture sand. However, the job was not successful because the uncoated fracture sand did not providing enough strength to keep the fracturing opened. The discovery of several type of proppant was continues in 1950's and natural fracture sand such as white and brown sand was widely used as proppant agent until today. White sand and brown sand are two types of fracturing sand. Because of their brownish surface colour, the sand is known as brown sand. Basically, brown sand has low price and more prone to crush at lower stress (Chen et al., 2012).

Quartz sand is one of natural proppant that widely used today. However, proppant is mostly produces from overseas and there is no supplier in Malaysia. Malaysia has potential to produce own proppant because there are abundant sources of sand in Malaysia. Besides, an alternative of producing proppant locally can reduce the well stimulation cost and also help to increase Malaysia economy. In industry today, various surface modification of sand has been observed to improve the performance of sand during hydraulic fracturing process for example is resin coated sand (RCS) (G, 2018).

Graphene Oxide (GO) is a layered nano-material that contains graphene sheets and oxygen bearing functional group (G, 2018). Graphene oxide can easily spread in organic solvent, such as water and different matrixes because of the existing oxygen