Relevant Applications

TECHNOLOGY TRANSFER OPPORTUNITY: Enabling geothermal co-produced applications by employing electromagnetic manipulation of magnetizable oil.

One of the aspects of geothermal co-produced applications near oil deposits is the generation of large volumes of byproduct processed water that inherently include oil contaminants. This water stream must be filtered and cleaned, preferably to the ultimate goal of the EPA limit of oil and grease (O&G) to 42 mg/L to make the site acceptable. Several stages of filtering and processing are currently used, but they generally result in residual dispersed oil droplets. The proposed technology should offer an improvement over the current state of the art for the removal of dispersed oil, which consists of small droplets suspended in the aqueous phase that are typically 4-6 microns in size. The objective is to create a product that separates hydrocarbons from other produced fluids to enable geothermal coproduced applications. There is also potential to implement the oil cleaning process at an earlier stage before the filtering process and the dispersal of oil into small droplets. We describe below a new concept that is the enabling process for the ideal solution of these problems, but it requires engineering solutions to fulfill the implementation at full scale.

The methods we describe are designed to work in conjunction with oil that has been rendered magnetic by inserting iron filings or magnetite (0.1 µm – 10 µm size) as described and demonstrated in previous documentation. See attached videos. More recent videos have been attained that show the innate attraction of oil and magnetite particles attributed to Van der Waals forces that then allow the magnetic fields to act on and manipulate the bonded entities. (High resolution images to be included at a later date)

The present invention relates to the use of micron-scale magnetite particles and magnetic forces to separate and manipulate oil from water by exploiting the bond between the magnetite particles and the oil. More specifically, these methods may be used to target oil droplets on the order of the scale of the magnetite introduced in the process. We had previously measured the magnetite particle sizes as 2-6 µm with an optical microscope at Argonne National Laboratory. This instrument used a standard green light illumination with an optical resolution of about 1 µm. The particles were scattered on a thin glass plate and then viewed under the microscope. A sample profile of a magnetite particle image is shown in Fig. 1. This match in size of the particles of interest should be an ideal, if not unique way to remove sub-10 µm size oil particles from water. We also note that the magnetite should be recoverable for reuse in the process, and the oil collectible.

Dispersion or injection of the magnetite particles into the processed water, attachment of oil to those particles, magnetic removal of the particles with oil from the water stream, separation of the magnetite from the oil, and recycling should be addressable in the application. It is also noted that the basic techniques might be applied effectively at an earlier stage in the processing cycle.

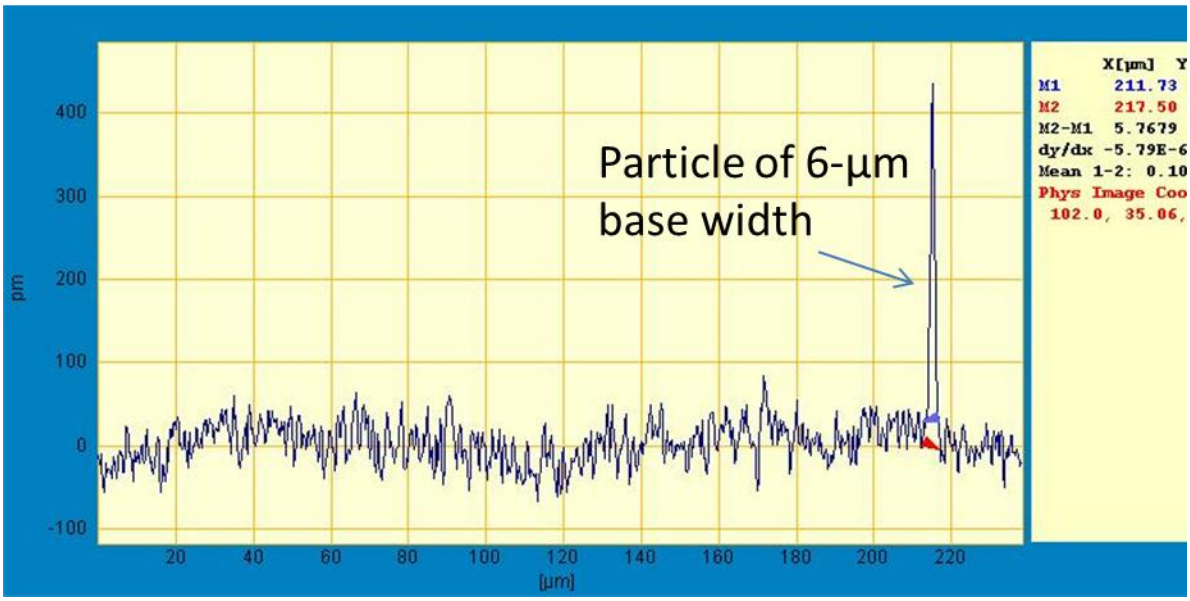

Fig. 1. Digital profile from an image of one of the magnetite particles as viewed by an optical microscope with 1-µm resolution at Argonne National Laboratory.