Nanoparticles as Proppants and Fluid Loss Additives in Hydraulic Fracturing

Summary:
The current invention is a method for using inexpensive and widely available silica nanoparticles as a fluid loss prevention agent and nanopropellant to maintain micro-fractures during hydraulic fracturing (fracking) to extract oil or natural gas from a variety of geological formations.

Overview:
Fracking as a method for extracting oil and natural gas from previously troublesome formations is becoming increasingly common. In recent years, fracking of tight oil formations has greatly increased the production of oil and gas in the US and elsewhere. As we explore the limitations of this method, it becomes clear that production can be further improved with micro- and nanoscale technologies.

Because fracking requires fracturing the geologic formation, there is a need to maintain the integrity of the pores in order to continue to extract the products. The current invention utilizes nanoparticles to better support the micro-fractures that are formed or opened through fracturing. These nanoparticles were chosen for their high resistance to compressive stress, availability/low cost, and ability to prevent fluid loss.

Application:
The current invention is used in fracking-based oil and gas extraction, especially for use in tight and ultra-tight formations.

How It Works:
This method strategically inserts nanoparticles into a hydraulically fractured well. The nanoparticles are moved based on size to fill in micro- and nano-fractures. This prevents fluid loss and reinforces the pore, resulting in an extended fracture network that exposes a greater amount of rock surface for oil and gas extraction.

Benefits:
This method prevents collapse of micro- and nano-fractures and propagates a fracture more efficiently with less fluid loss. The result is a reduction in the amount of water used during the fracking process and improved production of oil and/or gas from the formation. Further development of this technology could provide the opportunity to add coatings to the nanoparticles for improved performance and added benefits (such as the removal of clay particles from extracted oil).

Why It Is Better:
The current invention uses an inexpensive yet exceptionally efficient source of nanoparticles, reducing the overall cost of extraction. The physical properties of the nanoparticles identified by this research are especially well-suited for use as proppants in the types of fractures that are commonly seen in fracking applications.

Patents: US 62/171,648
Inventors: Reza Barati