DNA-Encapsulated Silica Nanoparticle Tracers for Fracture Characterization in Geothermal and Shale Gas/Oil Reservoirs

Abstract:

In geothermal and shale gas/oil fields, energy extraction is dependent on the network of fractures in the reservoir. Therefore, it is essential to understand the characteristics of the reservoir and its flow behavior. Specially manufactured micro- or nanoscale particles are promising tracer candidates because of the high degree of control of their physical and chemical properties compared with conventional solute tracers. In this work, we investigated a DNA-based nanoparticle tracer that has good thermal stability and great capacity for information storage due to its uniquely identifiable character.

The objective of our experiments has been to develop and evaluate a uniquely identifiable particle tracer for use in energy extraction applications. DNA-tagged nanotracers have been made by adsorbing synthetic DNA onto silica nanoparticles which were then coated with silica to protect the DNA.

Prof. Roland N. Horne

Stanford University, Thomas Davies Barrow Professor of Earth Sciences

Dr. Roland N. Horne is the Thomas Davies Barrow Professor of Earth Sciences and Professor of Energy Resources Engineering at Stanford University, and Director of the Stanford Geothermal Program. He was formerly the Chairman of the Department of Petroleum Engineering at Stanford from 1995 to 2006. He is best known for his work in well test interpretation, production optimization, and tracer analysis of fractured geothermal reservoirs. So far in his academic career he has supervised the graduate research of 45 PhD and 127 MS students, including about 50 in geothermal topics. Roland is an Honorary Member of the Society of Petroleum Engineers, and a member of the US National Academy of Engineering. He served on the International Geothermal Association (IGA) Board 1998-2001, 2001-2004, and 2007-2010, and was the 2010-2013 President of IGA. He was Technical Program Chairman of the World Geothermal Congress 2005 in Turkey and 2010 in Bali, and again in Melbourne in 2015. Roland is one of the founders of the IGA online database of geothermal conference papers.

During October 2015 to January 2016, he is a Visiting Researcher at the University of Tokyo, Frontier Research Center for Energy and Resources.