Core Analysis with Unilateral Magnetic Resonance – Bitumen Measurements in Alberta Tar Sands

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Low field time domain Magnetic Resonance is commonly used for laboratory measurements of fluid saturation and relaxation time distribution in reservoir core plug samples. Traditional measurements of this type require that the core plug sample be inserted into the confined measurement volume of an enclosed permanent magnet.

Extensive effort is being devoted world wide to developing unilateral magnetic resonance measurements and sensors where the measurement volume is displaced from the surface of a single sided magnetic resonance sensor[1]. There are numerous applications in food and material sciences however we have focused on core analysis with unilateral MR instruments. In measurements of this type the core or core plug sample is simply placed on top of the unilateral magnet array and the measurement is taken from a region of space some number of mm displaced into the sample to prevent surface disturbance effects. Scanning the measurement volume is accomplished by simple translation of the core sample. The simplicity of the permanent magnet array translates into a low cost reliable instrument. The magnet array fits in to the palm of ones hand and weighs less than 10 kg.

In our first application of these ideas to core analysis we have developed a rapid measurement of bitumen content in tar sands samples. Rational control of the magnet field properties of the sensitive volume yields a direct and simple measurement in a matter of minutes, with minimal sample handing. The magnetic resonance determined bitumen content corresponds well to conventional measurements in the limited number of samples tested to date.

References

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