

Thermal management of downhole electronics cooling in oil & gas well logging at high temperature

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Abstract:

Logging tools are widely used in deeper oil and gas wells in which the geothermal temperature can be as high as 200 °C. However, a majority of the downhole electronic components can only withstand ambient temperature not exceeding 120 °C. Therefore, an effective thermal management system is necessary for logging tools. In this paper, a thermal management based on the combination of the vacuum flask and phase change material (PCM) is proposed for enhancing the logging tools' temperature survival time. A framework assembly with test chips made of flat resistive heaters attached on the chassis was fabricated to simulate the real logging tool. The experiment set up was placed inside an oven to achieve the thermally harsh downhole environment. Experiments were conducted with total electronics heat dissipation of 30 W and constant ambient temperature of 200 °C. The results show that the proposed thermal management method can effectively reduce the temperature of the electronic components below 120 °C for six-hour operating time, which meets the requirement.

Published in: [Electronic Packaging Technology \(ICEPT\), 2016 17th International Conference on](#)

Date of Conference: 16-19 Aug. 2016

INSPEC Accession Number: 16357321

Date Added to IEEE *Xplore*: 06 October 2016

DOI: 10.1109/ICEPT.2016.7583211

▼ ISBN Information:

Electronic ISBN: 978-1-5090-1396-8

Publisher: IEEE

Print on Demand(PoD) ISBN: 978-1-5090-1397-5

Conference Location: Wuhan, China