

***Numerical and Experimental Investigation of
Miniature Cryocooler Constructed
Using Low-Temperature
Cofired Ceramic Technology***

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The Low Temperature Cofired Ceramic technology proved its maturity and successful application in number of micro- and nano-size devices and Lab-on-chip systems. It allowed for a stable and controlled performance of number of processes including transportation, mixing, (bio)chemical reactions, detection of micro- and nanoliter volume samples. The main advantage of LTCC technology is its manufacturing flexibility and very high endurance. It allows for a safe performance in extreme thermal and pressure conditions. In the current study the LTCC technology was used to manufacture a miniature cryocooler based on Joule-Thomson cycle. The size of the whole chip was in order of cm, the heat exchanger diameter was approximately 1 mm and the J-T section diameter was approximately 0.1 mm. The applicability of the LTCC technology for microcooling and its performance was investigated numerically using the conjugate heat transport approach and experimentally tested using high pressure nitrogen as a working fluid. The microcooling chip was designed and manufactured in Wrocław University of Science and Technology.