Temperature modelling of a biochip for DNA analysis

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Abstract: This paper describes the work on temperature modelling of an Electronic Detection Cell (EDC) for DNA analysis. The EDC is part of a biochip which is under development at INESC. The main goal of the project is to build a hand-held biochip with several sites for running simultaneous detection experiments with independent temperature profiles. The basic DNA detection electronic cell comprises a Thin Film Diode (TFD) in series with a Magnetic Resistive Tunnel Junction (MRTJ). The role of the MRTJ is to detect the presence of bio-molecules using magnetic bides. The TFD is to be used as a temperature sensor, to give information about the temperature at which the hybridization process is developing and also as a electronic selector of the hybridization site, Which are arranged in a matrix. Both the TFD and MRTJ will dissipate power but the main source of heat is a current line which is used to attract the bides to the MRTJ. Because of the structure of the biochip one must understand how heat diffuses between the heater and the hybridization site, and one must characterize the temperature distribution between the hybridization site, temperature sensor and the power input.

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