

DNA Hybridization Detection Using Microwave Resonators

Mircea DRAGOMAN¹, Alina Cismaru¹, Antonio RADOI¹, Daniela DRAGOMAN²

¹ National Institute for Research and Development in Microtechnology (IMT), P.O. Box 38-160,
023573 Bucharest, Romania

² Univ. Bucharest, Physics Dept., P.O. Box MG-11, 077125 Bucharest, Romania

Abstract — The unhybridized and hybridized states of the DNA (ss DNA and ds DNA) are detected using a miniaturized electromagnetic band gap microwave resonator. The two DNA states are detected unambiguously using a maximum frequency span 2.6 GHz. The transmission measurements were repeated on various resonators positioned on the same wafer and the results were reproduced with high accuracy. The span of 1 GHz between DNA two states was measured in the case when ss DNA was anchored directly on the surface of the electromagnetic bandgap microwave resonator with the frequency $f_0 = 17.3$ GHz, while a span of 2.6 GHz was measured when DNA is anchored to gold nanoislands decorating bamboo-shaped carbon nanotubes and 0.5 μ L of this solution is uniformly deposited on the surface of the electromagnetic bandgap microwave resonator with the frequency $f_0 = 16.07$ GHz. The big difference between the two states of DNA is due their different effective electrical permittivity in the microwave range.