

Titanium Nitride (TiN) Antennas for Medical Wireless Data Telemetry

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In the past several decades, the applications of wireless technologies have exponentially increased. One area that is emerging is the growing use of wireless technologies in healthcare. The use of antennas embedded with implanted sensors to transmit data need further development and research. In the case of medical applications, they require extremely small biocompatible antennas that can be implanted in the body for an extended period of time.

In this study, we examine Titanium Nitride (TiN), a material that can be used for implantable medical wireless telemetry. TiN can withstand high temperatures and is preferred for coating exposed mechanical material because its composition allows it to withstand heat and pressure. Especially, TiN is preferred for medical implants as a non-toxic exterior coating, with only a 5 μ m or less protection layer, making it extremely thin and protective, as well as bio-compatible. However, with a surprisingly high conductivity of 1×10^7 S/m, it is also suitable as a conductive radiative element in an antenna.

In this study, we present a biocompatible microstrip patch antenna design intended for implantable wireless telemetry applications, made through: the growing of sapphire crystal and depositing a TiN layer, following by the growing of Silicon Dioxide (SiO₂); several photolithographical steps using a mask, photoresist, and exposure; combined with chemical etching processes to produce the antenna topology on a sapphire wafer with metal contacts. The antenna was tested using skin-mimicking gel, which mimics the electrical properties of human tissue, to demonstrate and understand how the TiN antenna would function as an implant.