HOW HOT CAN A BROIDA-OVEN GET? THE PURE ROTATIONAL SPECTRUM OF TiF ($X^4\Phi_r$)

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The pure rotational spectrum of TiF in its $X^4\Phi_r$ state has been measured in the frequency range 140-525 GHz, using millimeter-wave direct absorption techniques. The radical was created by the reaction of titanium vapor, produced in a modified high temperature Broida-type oven, with SF_6. Twelve rotational transitions were recorded, each consisting of four spin-orbit components, as is expected for this ground state. In addition, hyperfine splittings, which arise from the ^{19}F nucleus (I = 1/2), were observed in every fine structure component. The data have been analyzed using an effective Hamiltonian, resulting in the determination of rotational, fine structure, and magnetic hyperfine parameters. These measurements have confirmed that the ground state of TiF is indeed $^4\Phi_r$. Implications of these measurements for bonding in 3d transition metal fluorides will also be discussed.