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Possible magnetic minerals constituents in the Martian crust and microstructures consistent with large remanent magnetizations

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Mars Global Surveyor (MGS) mission has played a unique role in the mapping of the Martian magnetic field. Thanks to the results and later data analysis of this mission it is known that Mars does not have a global bipolar magnetic field but that the crust presents areas of great magnetization. This fact is only compatible with a large concentration of highly magnetic minerals (magnetite) with a pinned monodomain magnetization [1, 2]. The next MetNet precursor mission (MMPM) aims to place a net of meteorological stations on the surface of Mars. In the first of them (est. 2014), among other payloads, the Spanish Institute of Aerospace Technology (INTA) has developed a miniaturized vector magnetometer with the goal of measuring the thermomagnetic response of the Martian soil around the lander. The work presented here discusses possible microstructures for the magnetic minerals in the Martian crust. The results presented will be focused on the titanomagnetites series [3] solid solution with compositions of: x (Fe_2TiO_4) - (1-x) (Fe_3O_4) with $0.30 < x < 1.00$. Thermoremanent curves of the minerals from room temperature to 4 K will be presented since the first objective of the magnetometer is the exhaustive characterization of the thermoremanent curves of the soil in the range of temperatures expected for the sensor: from 143 K up to 293 K and the later analysis for the soil modeling [4]. The final objective is to identify a natural mechanism of the solid solution decomposition capable of yielding a mineral rich in magnetite, monodomain and with the magnetization pinned, that can explain the large magnitude of the magnetic anomalies [5].

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