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Abstract #XXX (to be filled by the organizers)

Preferred Topics: SUSTSP / TESTING / STRMAT (3 maximum from the list of topics)

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Title

Thermite-for-Demise (T4D): Preliminary assessment on the effects of a thermite charge in plasma wind tunnel experiments

Authors

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Abstract

In the frame of SPADEXO ESA-TRP project, thermite use to aid spacecraft demise during re-entry is under investigation. Once placed on board, the energetic material charge could work as an extra enthalpy source. Thermites are good candidates for this role, as they release noticeable heat upon ignition and could be ignited passively by the heat experienced by the spacecraft during re-entry. The extra available heat could be exploited to provoke complete ablation of particularly robust components (Ball Bearing Units, Solar Array Drive Mechanisms, etc.) or to weaken structural connections, resulting in controlled early break-up. This thermite application concept has been already described in some patents [1-2] or preliminary studies [3], but many questions are still open. The SPADEXO project aims to outline some of the main answers needed and to define useful guidelines for future research on the topic.

After the selection of the thermite formulation and heat transfer concept to be used, the main step of SPADEXO project still to be performed is the experimental campaign in arc-heated wind tunnel L2K, located at DLR premises in Cologne, planned in early 2023. Four samples with simple different geometries have been designed to investigate the effectiveness of the thermite charge. One of the main aspects to be defined is the mass ratio between the sample and the thermite charge, to assess the measurability of the effect induced by the thermite ignition.

After a brief introduction on the ESA-founded SPADEXO project and its goals, the main outcomes of the breadboard design phase will be presented. The description of the samples' geometry, the main parameters to be studied and the numerical models developed to preliminarily assess the measurability of thermite effect will be the focus of the paper.

References

- [1] D. Dilhan and P. Omaly, *Élément de véhicule spatial a capacité d'autodestruction améliorée et procédure de fabrication d'un tel élément*, FR 2975080 B1, Filing year 2011.
- [2] R. Seiler and G. Smet., *Exothermic reaction aided spacecraft demise during re-entry*, European Patent EP 3 604 143 A1, Filing year 2018.
- [3] T. Schleutker, A. Guelhan, B. Esser and T. Lips, *Exothermic Reaction Aided Spacecraft Demise - Proof of Concept Testing – Final Report*, Contract No. 4000126547/19/NL/AR/ig, Issue 1, Revision 2.