PROCEDURES FOR THE DETERMINATION OF THE COLD COPPER CATALYCITY

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In the field of the design of the thermal protection systems of any vehicle carrying out an atmosphere reentry, the chemical properties of the material used are of prime importance since the heat flux resulting from the chemistry could represent a large amount of the total value.

In this DC-project, the concept of catalycity has been used in order to quantify these surface chemical properties and two methods have been developped to compute it. Those methods are based on the current VKI stagnation point computation which combine experimental measurements of heat flux and pitot pressure, CFD computation in order to determine the geometrical properties of the boundary layer and a post processing procedure. One of the main weak points of this VKI stagnation point computation is in the post processing procedure. Using intrusive measurement technique, the problem is due to the fact that among the two main unknowns of the computation, the outer enthalpy and the wall catalycity, only one single relation can link them. Therefore, the system cannot be solved. This project propose two methods in order to overcome this problem.

Since the enthalpy is linked to the catalycity by one single relation, it is possible to plot the enthalpy as a function of the catalycity, for several known parameters. The result is an curve with an S-shape. Several examples are illustrated on both figures. From such an S-curve, the enthalpy can be limited to the values associated to all the possible catalycities. The comparison between several 'S-curves' associated to probes with different parameters, but placed in the same plasma jet allows to restrict the possible values of enthalpy, since all the probes are submitted to the same amount of enthalpy. The **minimax method** compares the 'S-curves' of three probes with different material, but the same geometry (fig. 1(a)). This restriction in the enthalpy interval restricts the catalycity interval as well. The **equilibrium extrapolation method** is based on the extrapolation of the equilibrium boundary layer from the 'S-curves' of three probes with the same material, but different geometries (fig. 1(b)), in the same plasma jet.

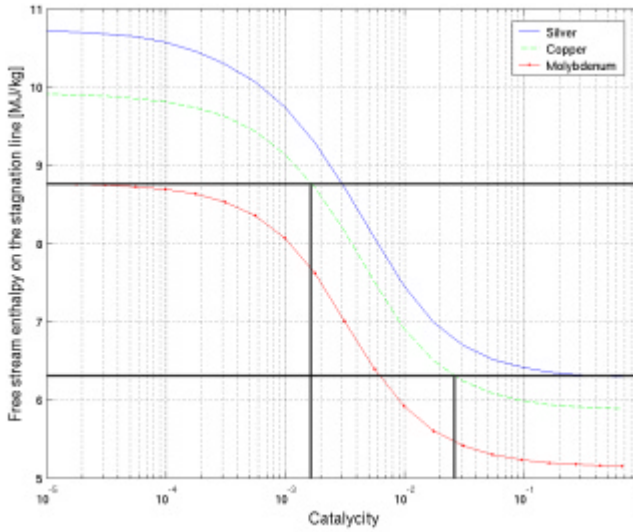

Figure 1(a): Minimax method example

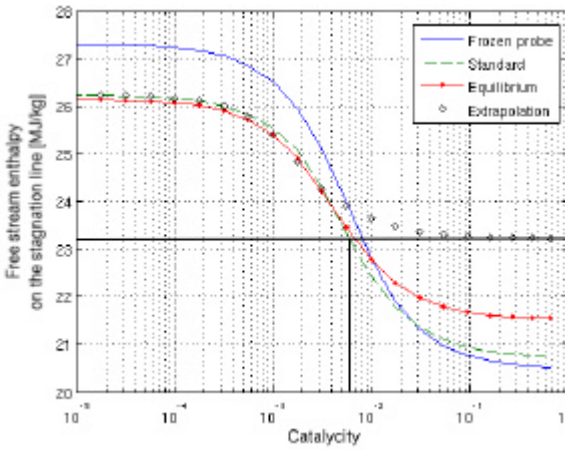

Figure 1(b): Equilibrium extrapolation example