A number of such studies, reported in Ref. 4, are summarized in Table 2, which lists accommodation coefficients determined for several motors together with information on motor geometry and target configuration. Also listed in Table 2 are the incident particle mass fluxes at the target location. These values were not available in Ref. 4 and were calculated from the listed chamber pressure, throat area, and alumina loading by assuming 1) a C^* velocity of 5500 fps and 2) that the particles at the target location were uniformly distributed within the nozzle cone angle. The shock-layer gas density which was determined from plume flowfield data,[4] was approximately 20 times less than that of sea-level air, except for the Centaur motor, where the density was another order of magnitude lower. For each case the particle mass and the shock layer density correspond to the regime of strong debris shielding as identified in Fig. 1 of Ref. 3. It is concluded, therefore, that the process of energy partitioning which occurred on these tests is similar to that described in the present paper. Since the interrelationship between energy partitioning and debris shielding is as yet unknown, the accommodation coefficients listed in Table 2 should be considered valid only for the specified test conditions and should not be applied to situations differing from those for which they were obtained.

In conclusion, the results of the present study show that in the case of strong shielding, the debris layer acts as an efficient energy sink which reduces the net energy flux to the target to as low as 10% of the kinetic energy flux of the freestream particles. As a consequence, the target is considerably cooler than the material within debris layer. However the detailed mechanisms of the formation of the debris layer and its subsequent interaction with the oncoming particles are still unresolved and require further investigation.

References

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