GLOSSARY

OF TERMS IN HIGH TEMPERATURE, THERMAL PROTECTION TECHNOLOGY

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FOREWORD

This glossary presents terminology and definitions frequently used in the technology relating to thermal protection as employed in the extreme environments of aerospace vehicle systems. The definitions presented in this glossary result from efforts to achieve clarity and conciseness, but with sufficient generality to enable progress toward standardization in nomenclature.

Definitions that are unduly biased toward particular applications, environments or materials contribute to a communications barrier between workers in related fields as well as administrators of programs involving those technological areas. It was the recognition of such a communications problem that caused the work on this glossary to be conceived, sponsored, and undertaken. The results may be considered as representing an "average" usage in Government and industrial laboratories active in the technology. Contributions from such groups were obtained by means of a series of ballots which provided for selection from among alternative definitions, and solicited critical review and comment. Each of those terms and phrases having definitions developed from the results of critical review and balloting are indicated by an underline.

The continued interest and cooperative efforts afforded by the members of the Critical Review and Balloting Panel (see Appendix) are gratefully acknowledged as significant contributions to this effort toward the development of uniform terminology applicable to the thermal protection field of technology.

This project was performed for the National Aeronautics and Space Administration under the provisions of, and in partial fulfillment of Contract NASr-182. Throughout the course of the project, liaison was maintained with ASTM Committee E-21 on Space Simulation, Subcommittee VI, Section 3 on Ablation, and this glossary has been provided as input to the work on definitions going on within the Committee.

ABLATION - Essentially a heat and mass transfer process in which thermal energy is expended by a sacrificial loss of material. In the process heat is absorbed, blocked, dissipated and/or generated by mechanisms of: Phase transitions (melting, vaporization and sublimation), mass transfer into the boundary layer; convection in the liquid layer (if one exists); radiant energy transport; conduction into the solid body; chemical reactions; and erosion. The relative importance of each of these mechanisms is dependent upon the particular material and environment involved.

ABLATION EFFICIENCY - (This term is not recommended for use. The sense that it has on occasions been given in the technical literature is: -The apparent heat absorbed or dissipated per unit of mass removed from the ablating specimen.

See EFFECTIVE HEAT OF ABLATION, EFFECTIVE HEAT CAPACITY.)

ABLATION, LINEAR RATE OF - The velocity of recession of an ablating surface, measured normal to the surface. For a charring material, the recession rate may alternatively refer to the pyrolysis interface.

ABLATION, MASS RATE OF - The time rate of mass change per unit area of the ablating surface.

ABLATIVE COOLING - A reduction in the heat transfer to a system or component thereof, due to ablation in a related protective system or component.

See ABLATION.

ABLATIVE MATERIAL - A material designed or formulated so as to dissipate incident heat by degrading through the process of ablation.

ABLATOR - A thermal protection system, or the component thereof, that blocks or retards heat transfer to the underlying structure by the process of ablation.

ABSOLUTE VISCOSITY - The ratio of the shearing stresses to the time rate of change of strain (deformation) in a flowing fluid. The time rate of strain may be expressed in terms of velocity gradients. (Also referred to as the coefficient of viscosity and dynamic viscosity.)

See DYNAMIC VISCOSITY.

ABSORPTANCE - (1) A property of a body, defined as the ratio of the rate of absorption of radiant energy to the rate of incidence of radiant energy upon the body.

(2) The radiant power per unit area absorbed by a body.

Editor's Note: The considerable efforts toward standardization of radiation terminology have not as yet resulted in broadly accepted definitions. Until a standard is accepted, it may be advisable to state definitions within reports and papers to avoid misinterpretation.

ABSORPTIVITY - A special case of absorptance; absorptivity is a fundamental property of a material, defined as the absorptance of a specimen that has an optically smooth surface and is sufficiently thick to be opaque.

Editor's Note: The considerable efforts toward standardization of radiation terminology has not resulted in broadly accepted definitions. Until a standard is accepted it may be advisable to state definitions in reports and papers to avoid misinterpretation.

ADIABATIC EFFICIENCY - The degree to which a change in state within a thermodynamic system approaches an adiabatic (no heat transfer across boundaries of the system) process. (For a flow process in which energy is removed, the adiabatic efficiency can be defined as the ratio of the actual change in enthalpy to the change in enthalpy that would have occurred had no heat been removed from the system.)

ADIABATIC PROCESS - A thermodynamic process in which heat is neither added to, nor removed from the system involved. When the process is reversible it is called isentropic.

ADIABATIC WALL - A boundary that is a perfect heat insulator (neither emits nor absorbs heat) in a thermodynamic system. In boundary layer theory, the wall condition in which the temperature gradient at the wall is zero.

ADIABATIC WALL TEMPERATURE - See RECOVERY TEMPERATURE

AERODYNAMIC HEATING - The transfer of heat to a body due to relative motion between the body and the surrounding atmosphere. Flow of the gas relative to the surface of the body results in dissipation of energy as heat.

AEROTHERMODYNAMICS - The study of the interrelated aerodynamic and thermodynamic problems associated with aerodynamic heating.

BLACK BODY - A black body, or ideal radiator, is a theoretical concept and may be defined either as a body which completely absorbs all radiation incident upon it, or as a radiator which at any specified temperature emits the maximum possible amount of thermal radiation at all wavelengths. A black body is a standard with which the radiation characteristics of other bodies may be compared.

BOUNDARY LAYER - A layer of fluid adjacent to the surface of a body where the effects of transport properties (viscosity, thermal conductivity and diffusivity) are important, and gradients of velocity, and/or temperature, and/or specie concentration occur. The boundary layer thickness is defined as the distance along a normal from the surface to an arbitrarily chosen point, e.g., where the value of the particular variable of concern attains 99% of the local free stream or bulk fluid value.

See CONCENTRATION BOUNDARY LAYER, THERMAL BOUNDARY LAYER, and VELOCITY BOUNDARY LAYER.

BRIGHTNESS TEMPERATURE - The temperature corresponding to the black body emission spectrum curve which just touches the emission spectrum curve of the body being observed. Since the emittance of the surface cannot be greater than unity, this temperature is a lower limit for the observed surface. Comparisons of emission spectra are commonly made in some narrow wavelength interval centered at 0.65 microns.

Editor's Note: For an ablating body, the temperature determined by the indicated method may be more appropriately labeled as the "minimum surface temperature."

BULK TEMPERATURE - In heat transfer, the temperature of the bulk of the fluid. More precisely, for internal flow, the weighted mean temperature of the fluid in a cross section; in external flow, the temperature of the fluid at a sufficiently large distance from any surface so that the local temperature gradient is effectively zero.

CATALYTIC HEAT TRANSFER - Heat transfer to the surface of a body in a dissociated fluid due to catalytic recombination at or near the surface.

CHAR - A residue of rigid, porous structure resulting from severe thermal degradation of an organic material. Also often used to refer to any solid residue formed by thermal degradation of a material.

CHEMICAL HEATING - Heating resulting from exothermic chemical reactions.

CONCENTRATION BOUNDARY LAYER - That layer of fluid adjacent to a boundary or surface, in which a species concentration gradient, normal to the surface, occurs.

See BOUNDARY LAYER.

COEFFICIENT OF VISCOSITY - See ABSOLUTE VISCOSITY.

DISSOCIATION - The reversible splitting of a molecule into simpler units, such as smaller molecules, atoms or ions.

DYNAMIC VISCOSITY - The same physical property as ABSOLUTE VISCOSITY, the difference is merely the system of units used in their evaluations. For example, in engineering units,

$$\mu_f \left(lb_f \text{ sec}/ft^2\right) = \frac{\mu\left(lb_m/\text{sec ft}\right)}{g_c}$$

Where μ_f is dynamic viscosity, μ is absolute viscosity, and g_c is the dimensional conversion factor, 32.2 ft lb_m/lb_f sec^2.

EFFECTIVE HEAT OF ABLATION - A figure of merit defined for a material subjected to steady-state heating conditions and undergoing steady-state ablation. The quantity represents the heat dissipated per unit mass of ablated material. The effective heat of ablation relates to the complex interaction between the ablating material and its environment, and consequently is not a constant property of a given material, but rather its magnitude depends on both the material's properties and characteristics of the exposure environment.

EFFECTIVE HEAT CAPACITY - The ratio denoting the total amount of cold-wall heat input accomodated per unit mass of an ablative heat shield, before the back-face temperature exceeds a specified maximum. This overall performance parameter can be used to indicate both ablation and insulation thickness requirements for specified maximum increase in rear surface temperature and cold-wall heat input.

Editor's Note: This parameter has been afforded only limited acceptance by workers in this field.

EFFECTIVENESS OF ABLATION MATERIAL - See EFFECTIVE HEAT CAPACITY.

Editor's Note: This terminology is preferred by some investigators to describe the performance parameter indicated in this glossary as EFFECTIVE HEAT CAPACITY.

EMISSIVITY - Emissivity, a characteristic of a material, is the ratio of the rate of emission of radiant energy from an opaque and optically smooth

specimen of that material as a consequence of its temperature only, to the corresponding rate for a black body at the same temperature.

See EMITTANCE (emissivity is a special case of emittance).

Editor's Note: The considerable efforts toward standardization of radiation terminology have not as yet resulted in broadly accepted definitions. Until a standard is accepted, it may be advisable to state definitions within reports and papers to avoid misinterpretation.

EMITTANCE - Emittance, a characteristic of a body or portion of a body (rather than the material composing it), which at any constant temperature, is the ratio of a rate of emission of radiant energy by the body as a consequence of its temperature only, to the corresponding rate for a black body at the same temperature. [Emittance varies with viewing angle and thus must be qualified as to whether it relates to a particular angle (as in "normal emittance") or whether it is integrated over the range of angles (hemispherical emittance"). Further qualification is required pertaining to the range of wavelengths observed, whether a very limited range ("spectral emittance") or all wavelengths of radiation ("total emittance")].

Editor's Note: The considerable efforts toward standardization of radiation terminology have not as yet resulted in broadly accepted definitions. Until a standard is accepted, it may be advisable to state definitions within reports and papers to avoid misinterpretation.

ENDOTHERMIC REACTION - Designating or referring to a chemical reaction in which heat is absorbed (corresponding to an increase in enthalpy).

ENTHALPY - A thermodynamic property, or state variable defined as: $H=U + pV$ where H is enthalpy, U is the internal energy of the system, p is the pressure, and V is the volume. Sometimes also called "heat content".

EROSION - The wearing away of surface material due to the action of moving liquids or gases; may be accelerated by presence of suspended solid particles and in some cases by corrosive action of the fluid.

EXOTHERMIC REACTION - Designating or referring to a chemical reaction in which energy is liberated as heat (corresponding to a decrease in enthalpy).

FILM COOLING - A reduction of heat transfer to a body due to a relatively stable film of fluid forming over the surface. The film may be the result of a thermally induced phase change in the surface material or, injected through holes or slots in the surface or through a porous surface.

See INJECTION COOLING, MASS TRANSFER COOLING, and TRANSPIRATION COOLING.

FLUX - The rate of flow which is the quantity of mass, momentum and/or energy which crosses or passes through a unit area in a unit of time.

FREE-MOLECULE FLOW REGIME - That flow regime of gas dynamics characterized by the mean free path (the average distance travelled by a molecule between collisions with other molecules) being much larger than the characteristic dimension of the body in the flow field, so that molecule-molecule collisions are negligible in comparison with molecule to body-surface collisions.

GAS DYNAMIC HEATING - See AERODYNAMIC HEATING.

GASIFICATION RATIO - That fraction of the mass lost by an ablating solid which enters the gas phase;

$$\text{Gasification Ratio} = \frac{\text{Mass Vaporization Rate}}{\text{Mass Ablation Rate}}$$

HEAT OF ABLATION - The total of the incident heat that an ablative material dissipates per unit mass ablated.

See EFFECTIVE HEAT OF ABLATION, EFFECTIVE HEAT CAPACITY.

HEAT CONTENT - See ENTHALPY.

HEAT OF DECOMPOSITION - The amount of heat absorbed or liberated per unit mass of material due to the chemical reactions associated with a change or breakdown of the molecular structure of the material.

HEAT SINK - The element of a system, which by virtue of its thermal properties is capable of absorbing large amounts of heat relative to the heat contained within the system. Such a material (or device) is used to remove heat from the system under consideration.

HEAT STORAGE - Retention of heat in a body, accomodated by an increase of its temperature and/or phase change or chemical reaction.

Editor's Note: The phase "heat storage" involves a contradiction of words since heat is a transient form of energy; it is not recommended terminology.

HEAT TRANSFER, CONDUCTION - A process by which heat is transferred from a region of higher temperature to a region of lower temperature within a medium (solid, liquid, or gas), or between mediums in direct physical contact. The process does not involve relative motion between the higher and lower temperature particles.

See HEAT TRANSFER, CONVECTION and HEAT TRANSFER, RADIATION.

HEAT TRANSFER, CONVECTION - A process of transportation and exchange of thermal energy in fluids due to a combination of mixing motion between higher and lower temperature portions of the fluid mass, and the heat conduction process.

See HEAT TRANSFER, CONDUCTION.

HEAT TRANSFER, RADIATION - A process of thermal energy transmission by electromagnetic waves between bodies or masses (solids or fluids) that are separated in space. The quantity and direction of energy transfer

depend upon the radiation emission and absorption characteristics, temperature, and spatial relationship of the bodies involved, as well as the radiation transmission characteristics of the intervening medium.

HEMISPHERICAL EMITTANCE - Integrated emittance that would be intercepted by a hemisphere positioned over a segment of the surface (circumscribed by the great circle of the hemisphere) of a body emitting radiation.

See EMITTANCE.

Editor's Note: The considerable efforts toward standardization of radiation terminology have not as yet resulted in broadly accepted definitions. Until a standard is accepted it may be advisable to state definitions within reports and papers to avoid misinterpretation.

HYDRODYNAMIC BOUNDARY LAYER - See VELOCITY BOUNDARY LAYER.

HYPERSONIC FLOW - Fluid flow at very high supersonic speeds in the Mach number range of the order of 5 or greater. (Mach 5 is an arbitrary lower limit and has no significance apart from having been frequently used in this context.)

HYPERSONICS - That branch of aerodynamics that deals with very high supersonic speeds, sometimes defined as relating to Mach numbers of 5 or greater.

IMPACT PRESSURE - See PITOT PRESSURE.

INDUCTION TIME - Editor's Note: The several definitions associated with this phrase in the technical literature are inconsistent. A significant consensus was not achieved by the panelists contributing to this glossary. Frequently employed definitions are:

(1) The time interval from the initiation of a process (such as ablation or combustion) until a constant rate is established.

(2) The time interval which would be required to accumulate the thermal energy stored in

the steady-state temperature distribution of the body, if no heat were carried away by ablation.

See TRANSIENT PERIOD.

INJECTION COOLING - A form of mass transfer cooling accomplished by injecting a fluid into the local flow field through openings in the surface of a body, to reduce the heat transfer rate to the underlying body by: absorption of energy by the injected fluid; thickening of the boundary layer so that temperature and velocity gradients near and normal to the surface are reduced; and in some cases by modifying the flow field, as by forward injection to alter the shape and position of a shock wave.

See MASS TRANSFER COOLING and TRANSPIRATION COOLING.

INTUMESCENT INSULATOR - A material which expands, swells, or bubbles up upon heating and thereby incurs a reduction of its effective thermal conductivity.

KINEMATIC VISCOSITY - The ratio of the absolute viscosity of a fluid to its density.

KNUDSEN NUMBER - The ratio of the molecular mean free path in a gas to some significant dimension of a body moving in the gas. This ratio is a measure of the degree of rarefaction of the gas. When the molecular mean free path (the average distance traveled by a molecule between collisions) is of the same order of magnitude as a significant dimension of the body, the flow is considered rarefied.

LAMINAR FLOW - A smooth flow in which no random motion or cross-flow, other than molecular motion, occurs; hence a flow thought of as being comprised of thin parallel layers.

LIQUID FILM COOLING - See FILM COOLING.

LOW TEMPERATURE ABLATOR - An ablative material, usually organic in composition, the surface of which will not exceed an arbitrarily established temperature limit (usually 1800F), regardless of the incident heat flux.

Editor's Note: The usefulness of this terminology is questionable and was strongly challenged by several of the panelists contributing to this glossary due to the very arbitrary temperature limit indicated for low temperature ablative materials.

MACH NUMBER - A number expressing the ratio of the velocity of a body, or of a point on a body, with respect to the surrounding fluid, or the ratio of the velocity of fluid flow, to the local speed of sound in the fluid.

MASS TRANSFER COOLING - A class of cooling techniques characterized by an energy-consuming expenditure of mass (solid, liquid or gas). Included in this class of cooling techniques are ablation, injection cooling, and transpiration cooling, each having its own peculiar mechanism and additional cooling characteristics.

See ABLATION, INJECTION COOLING, and TRANSPIRATION COOLING.

MASS TRANSPIRATION COOLING - See TRANSPIRATION COOLING.

NORMAL EMITTANCE - Emittance in the direction perpendicular to the specimen surface.

See EMITTANCE.

NUSSELT NUMBER - A dimensionless number relating convective to conductive heat transfer between a solid boundary and a moving fluid, defined by the equation:

$$Nu = \frac{hL}{k}$$

where h is the convective heat transfer coefficient, L is the characteristic dimension of the body, and k is the thermal conductivity of the fluid.

PITOT PRESSURE - The experimentally determined pressure of the fluid at the point of stagnation (zero velocity) on a forward-facing pitot probe (tube) around which the fluid flows. (In subsonic flow, pitot pressure is equal to the stagnation pressure only if the flow remains in thermodynamic equilibrium. In supersonic flow, the pitot pressure is the stagnation pressure behind a normal shock and therefore is less than the stagnation pressure of the free stream.)

See STAGNATION PRESSURE.

PLASMA - An electrically conductive gas comprised of neutral particles, ionized particles and free electrons but which, taken as a whole, is electrically neutral.

PLASMA SHEATH - An envelope of partially ionized gas that surrounds a body moving relative to an atmosphere at hypersonic velocity.

PRANDTL NUMBER - A dimensionless parameter which indicates the significance of momentum transport relative to heat transport in a fluid flow, defined by the equation:

$$Pr = \frac{\mu c_p}{k}$$

where μ is the viscosity coefficient, c_p is the specific heat at constant pressure, and k is the coefficient of thermal conductivity.

PYROLYSIS - Chemical decomposition of a material brought about by the action of heat. (In the technology of thermal protection, this term generally relates to the breakdown of complex materials, such as polymeric compounds, into simplier units, such as gases and char.)

RECOVERY TEMPERATURE - The steady-state temperature attained by the surface of a body immersed in a fluid flow when heat conduction to the interior of the body and heat loss by radiation are both zero. This temperature is also referred to as "adiabatic wall temperature".

REFLECTANCE - The ratio of the radiant flux reflected by a body to that incident upon it.

Editor's Note: Because of prevalent nonuniformity in definitions applied to radiation terminology, it may be advisable to state definitions within reports and papers to avoid misinterpretation.

RESERVOIR PRESSURE - The free-stream total pressure (as usually applied to wind tunnel or other experimental work).

See TOTAL PRESSURE and STAGNATION PRESSURE.

REYNOLDS NUMBER - A dimensionless parameter representing the ratio of the inertial forces to the viscous forces in a fluid flowing relative to a body. It is usually expressed as:

$$Re = \frac{\rho U^2 L^2}{\mu UL} = \frac{\rho UL}{\mu}$$

where ρ is the density of the fluid, U is the fluid velocity, L is a characteristic dimension of the body, and μ is the coefficient of viscosity of the fluid.

SCHMIDT NUMBER - A dimensionless parameter which indicates the significance of momentum transport to mass transport in a flowing fluid. Defined by:

$$Sc = \frac{\mu}{\rho D_v}$$

where μ is the viscosity coefficient ρ is the density and D_v is mass diffusivity.

SENSIBLE ATMOSPHERE - That part of an atmosphere that offers significant resistance to a body passing through it.

SENSIBLE HEATING - Retention of sufficient thermal energy in a material to result in an increase in its temperature.

See HEAT STORAGE.

SLIP FLOW - Flow in the transition regime of gas dynamics (between continuum and free-molecule-flow), wherein the mean free path of the gas molecules is of the same order of magnitude as the thickness of the boundary layer. The gas in contact with a body surface immersed in the flow, is no longer at rest with respect to the surface.

See FREE-MOLECULE FLOW REGIME.

SPALLING - The breaking or tearing away of surface material from a body due to localized stresses, attendant to mechanical and/or thermal loading.

SPECTRAL EMITTANCE - The emittance within a narrow wavelength interval.

See EMITTANCE.

STAGNATION POINT - A point in a flow field about a body immersed in a fluid, where the fluid particles have zero velocity with respect to the body.

STAGNATION PRESSURE - (1) The pressure that would be attained if a flowing fluid were brought to rest isentropically. (This definition is generally applied in analytical work.) When used without further qualification this phrase refers to conditions upstream of a body and the associated shock front. Stagnation pressure decreases across a shock and varies from streamline to streamline behind the shock front.

See TOTAL PRESSURE AND RESERVOIR PRESSURE.

(2) The pressure of the fluid at a point of stagnation (zero velocity) on a body around which the fluid flows. (This definition is widely used in experimental work.)

See TOTAL PRESSURE AND PITOT PRESSURE.

STAGNATION REGION - The region in the vicinity of a stagnation point in a flow field about a body where the fluid

velocity relative to the body is negligible.

See STAGNATION POINT, STAGNATION PRESSURE, STAGNATION TEMPERATURE.

STAGNATION TEMPERATURE - The temperature that would be realized in a gas if it were brought to rest isentropically from a given flow velocity. If the specific heat at constant pressure can be assumed to be constant, then it is only necessary that the process be adiabatic.

See TOTAL TEMPERATURE.

STANTON NUMBER - The dimensionless ratio of the local convective heat transfer coefficient between a surface and a fluid flow, to the product of the density, specific heat and velocity of the fluid:

$$St = \frac{h}{\rho\ c_p\ U}$$

where h, the local convection heat transfer coefficient, is defined as the rate of heat flow per unit area divided by the temperature difference between the surface and the free stream, ρ and c_p are the density and specific heat of the fluid and U is the velocity of flow. The density and velocity may be defined at free-stream conditions (ρ_∞, U_∞) or at local conditions such as at the edge of the boundary layer. For hypersonic flow conditions:

$$\frac{h}{c_p} \text{ is sometimes replaced by } \frac{(q/A)}{(H_e - H_w)}$$

where q/A is the heat flux per unit area, and $(H_e - H_w)$ is the enthalpy difference from the edge of the boundary layer to the wall.

SUBLIMATION - The phase change of a substance directly from solid to gas (without apparent liquefaction).

SUPERSONIC FLOW - Fluid flow at speeds greater than the speed of sound in the medium under the prevailing conditions.

See HYPERSONIC FLOW.

SWEAT COOLING - See TRANSPIRATION COOLING and MASS TRANSFER COOLING.

TEMPERATURE RECOVERY FACTOR - The ratio of the actual temperature rise across a boundary layer adjacent to an insulated wall, to the adiabatic temperature rise, i.e.

$$R_t = \frac{T_i - T_\infty}{T_t - T_\infty}$$

where T_i is the temperature of the insulated (adiabatic) wall, T_t is the total temperature, and T_∞ is the free-stream temperature.

THERMAL ACCOMODATION COEFFICIENT - An experimentally determined quantitative indication of the interaction process between impinging molecules and the surface of a body in free molecule flow. It is defined as:

$$\alpha = \frac{(e_i - e_r)}{(e_i - e_s)}$$

where e_i is the energy transport rate of the incident molecules per unit area, e_r is the energy transport rate of re-emitted molecules per unit area, and e_s is the energy flux that would be reflected from the surface if all the incident molecules were re-emitted with Maxwellian distribution at the body surface temperature.

THERMAL BOUNDARY LAYER - A layer of fluid adjacent to a boundary or surface in which a temperature gradient occurs normal to the surface. The boundary layer thickness is defined as the distance along a normal to the surface to an arbitrary chosen point, e.g., where the temperature is 99% of the free-stream or bulk fluid value.

See BOUNDARY LAYER.

THERMAL DIFFUSIVITY - A material characteristic parameter defined as the ratio of thermal conductivity to thermal capacity (the product of specific heat and density):

$$a = \frac{k}{c\rho}$$

THERMOCHEMICAL HEAT OF ABLATION - The total of the incident heat that an ablative material dissipates per unit mass ablated, by mechanisms other than radiation.

See ABLATION and HEAT OF ABLATION.

TOTAL EMITTANCE - Emittance over the entire spectrum of emitted wavelengths.

See EMITTANCE.

TOTAL PRESSURE - The pressure that would be attained if a flowing fluid were brought to rest isentropically.

See STAGNATION PRESSURE and RESERVOIR PRESSURE.

TOTAL TEMPERATURE - The temperature of a fluid that would be realized if the fluid were brought to rest isentropically from a given flow velocity. For an ideal gas the process need only be adiabatic.

See STAGNATION TEMPERATURE.

TRANSIENT PERIOD - (1) The time interval before steady-state temperature distribution is obtained in a heated body.

(2) For an ablating body, the time interval before quasi-steady-state ablation is established.

TRANSPIRATION COOLING - A form of mass transfer cooling in which a body having a porous surface, is cooled by the controlled flow of a heat-absorbing fluid from within the body through the heated surface. Cooling is accomplished through absorption of heat by the coolant fluid, and thickening of the boundary layer resulting in reduction of the temperature gradients normal to the surface.

See MASS TRANSFER COOLING and INJECTION COOLING.

VELOCITY BOUNDARY LAYER - That layer of fluid adjacent to a boundary or surface in a stream, in which a velocity gradient occurs normal to the surface. The velocity boundary layer thickness is defined as the distance along a normal to the surface to an arbitrarily chosen point, e.g., where the velocity is 99% of the free-stream value.

See BOUNDARY LAYER.

APPENDIX

The organizations and individuals listed below, contributed information and evaluations of terminology and definitions, which were essential inputs to this glossary. These participants comprised a Critical Review and Balloting Panel for this project involving terminology and definitions used in the technology of thermal protection systems as applied to aerospace vehicle systems. The definitions given for the underlined terms and phrases were developed on the basis of: the preferences indicated by the panelists from among alternative definitions provided in a series of ballots; the modifications to the balloted definitions, recommended by the panelists; and definitions submitted by the panelists as preferred over those alternatives provided in the ballots.

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