

HEAT AND MASS TRANSFER IN GASOLINE AND DIESEL ENGINES

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Whenever a layman asks me what the science of heat and mass transfer is all about, I direct his attention to his automobile engine. All drivers know that cars become hot under normal circumstances, and that sometimes they over-heat, with dire effects. Some are acquainted with starting difficulties in cold weather; and those who have forgotten to fill the cooling system with anti-freeze will have sometimes encountered ice-formation, which interrupts the flow of water and may even lead to rupture of the passages which should contain it. Reflecting on these experiences, most people discover that they are better acquainted with heat- and mass-transfer knowledge than they supposed.

The reciprocating engine is indeed a device which exhibits every major phenomenon in the HMT repertoire, from "simple" heat conduction in the engine block, through single-phase convection in the (normally operating) cooling-water system and in the air passing over the extended surfaces of the (inappropriately named) "radiator", to the phase-change processes in the inlet manifold and the engine cylinder itself. The fluid-flow aspects are of great importance; and exothermic chemical reaction is vital; but it is the heat- and mass-transfer processes which enable the hydrodynamics and the chemistry to interact.

The 1987 Symposium of ICHMT showed how well the automotive industry, and those who work for it in universities and research institutes, recognise the importance of heat- and mass-transfer processes as determinants of the effectiveness of engine design and performance. Inspection of the list of papers supplied in the Appendix to this review reveals this.

The Symposium is of too recent date to allow the passage of time to distinguish the more-ephemeral papers from those of enduring value. However, there were so many good ones that it is not hard to select one which will assuredly endure - provided that it is not necessary to categorize it as the most valuable. Even if that proviso is disallowed, I am sure that I cannot be far wrong in selecting for prominence, and reproduction here, the review paper with which the Symposium began, namely that by Professor R. Pischinger of the University of Graz in Austria, entitled: "The importance of heat transfer in engine design and operation". Its author was invited to

deliver the opening lecture because of his authoritative previous publications and because he enjoyed the reputation of being a meticulous preparer and lucid deliverer of lectures. All who were present at the Dubrovnik meeting will agree that Professor Pischinger's authority and reputation stood even higher at its end than its beginning.