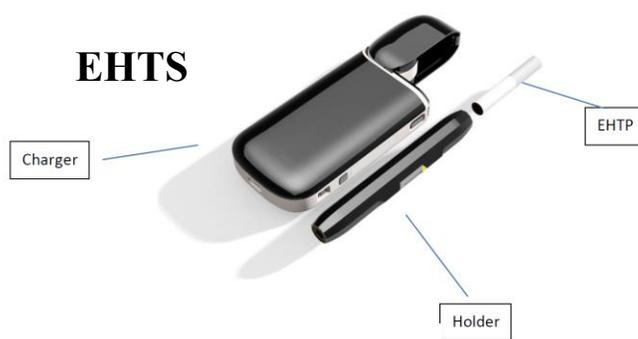


Philip Morris International (PMI) has developed a patented Electrically Heated Tobacco System (EHTS) that heats a specifically designed tobacco product (Electrically Heated Tobacco Product or EHTP). The EHTP contains tobacco¹ material in the form of a plug that undergoes a controlled heating process to produce a tobacco vapor (aerosol). The tobacco is only heated and is not burnt as happens in a lit cigarette.



PMI retained Dr. Guillermo Rein to review and analyze scientific data on the thermal processes taking place in the EHTP during aerosol generation and more specifically to assess whether combustion of the tobacco material in the EHTP occurs and if smoke is generated. Dr. Rein is a Reader in Thermal Energy (recently promoted to Professor of Fire Science) at the Department of Mechanical Engineering of Imperial College London, United Kingdom. He is an internationally recognized leader in fire safety and combustion research and an expert in the field of heat and mass transfer, with more than 75 journal publications and 150 conference communications. His work covers a wide area of combustion research in built and natural environments including: ignition, fire spreading, wildfires, structural fire resistance, and smoldering combustion of biofuels. He has received a large number of international research awards including the Society of Fire Protection Engineers (SFPE) Lund Award, the International Association of Wildland Fire's Early Career Award, the Combustion Institute's Hinshelwood Prize, and 2 Distinguished Paper Awards at International Combustion Symposium). He is Editor-in-Chief of the peer-reviewed scientific journal *Fire Technology* (official research journal of the National Fire Protection Association (NFPA), and the Society of Fire Protection Engineers (SFPE)).

Dr. Rein reviewed the operation of the EHTS, analyzed experimental data on the EHTS provided by PMI (that included data generated by independent analytical laboratories), and carried out independent temperature measurements in the EHTS to assess whether any combustion process occurs in the EHTP and if the aerosol formed is smoke.

¹ The EHTP does not contain tobacco cut-filler (tobacco leaf cut in small pieces found in cigarettes) or pipe tobacco. All of the tobacco in the EHTP is reconstituted (cast-leaf) tobacco made from tobacco powder, water, glycerin, guar gum and cellulose fibers.

Combining experimental evidence that he obtained independently on how the EHTS device functions (eg. its heat control and the temperature characteristics in the EHTP during use) with his expert knowledge of combustion science, Dr. Rein concluded that combustion reactions are not occurring because:

1. the peak temperature of the tobacco in the EHTP is too low to ignite the combustion process.
2. there is no propagation or sign of any exothermic reaction in the tobacco during normal operation of the EHTS.
3. no ash is formed during normal operation of the EHTS

Based on these findings, Dr. Rein opines that:

- the EHTS, as designed, operates in a thermal regime where combustion of the tobacco in the EHTP does not take place. It operates in a thermal regime that allows for only drying, evaporation and low temperature pyrolysis reactions.
- as there is no combustion taking place in the EHTS, the airborne substances released by the EHTP during use are not smoke.