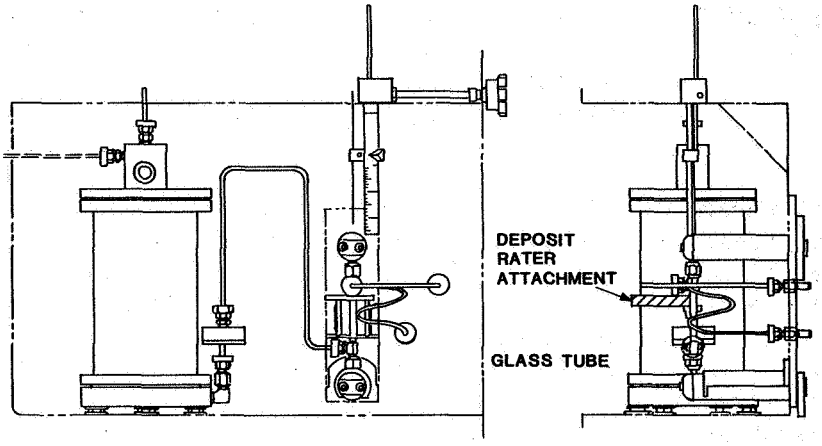
DETERMINATION OF JET FUEL THERMAL DEPOSIT RATE USING A MODIFIED JFTOT

C. J. Nowack and R. J. Delfosse
Naval Air Propulsion Center

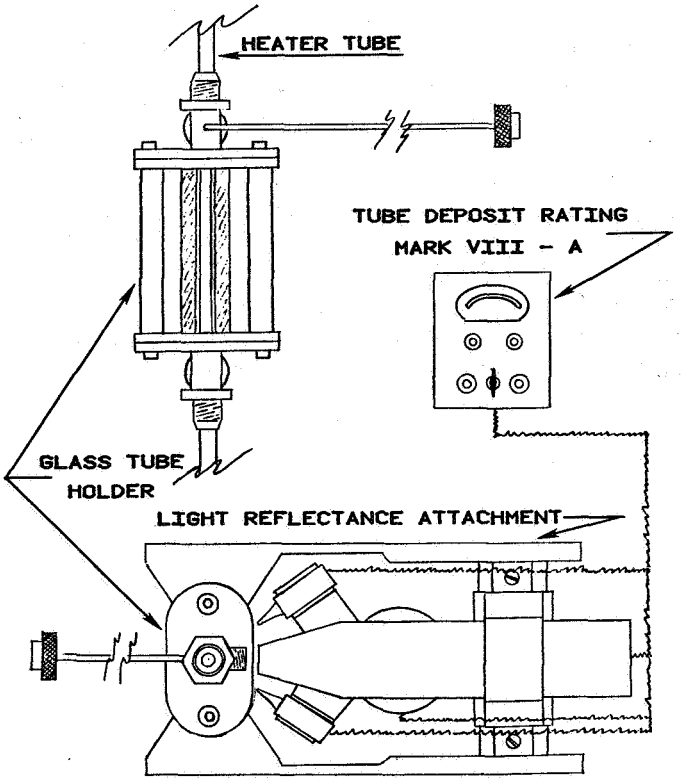
The current thermal oxidation stability limit for military and commercial aviation turbine fuels is a breakpoint temperature of no less than 260°C (500°F) as measured by the Alcor Jet Fuel Thermal Oxidation Tester (JFTOT). Today's engines are designed to tolerate a fuel with this stability limit, however, there are indications that fuel stability may be on the downtrend, which could affect future engines' performance. If future fuels are to have a lower stability, attempts must be made to provide a better definition of the breakpoint temperature in terms of a fuel performance parameter, for example, a deposit formation rate. In this study the JFTOT was modified with a glass tube enclosure of the heater test section and a light reflectance attachment, which permitted a direct measurement of deposit formation as a function of time.

Three fuels having different breakpoint temperatures were studied in the modified JFTOT. The lower stability fuel with a breakpoint of 240°C (465°F) was first stressed at a constant temperature. The cut-off point of the run is a deposit rating (TDR) of 12, as indicated by the Mark VIII, a light reflectance meter. After repeating this procedure at several different temperatures, an Arrehenius Plot was drawn from the data. The correlation coefficient and the energy of activation were calculated to be 0.97 and 8 kcal/mole respectively. Two other fuels having breakpoint temperatures of 271°C (520°F) and 285°C (545°F) were also studied in a similar manner. A straight line was drawn through the data at a slope equivalent to the slope of the lower stability fuel. The deposit formation rates for the three fuels were determined at 260°C (500°F), and a relative deposit formation rate at this temperature was calculated and plotted as a function of the individual fuel's breakpoint temperatures.

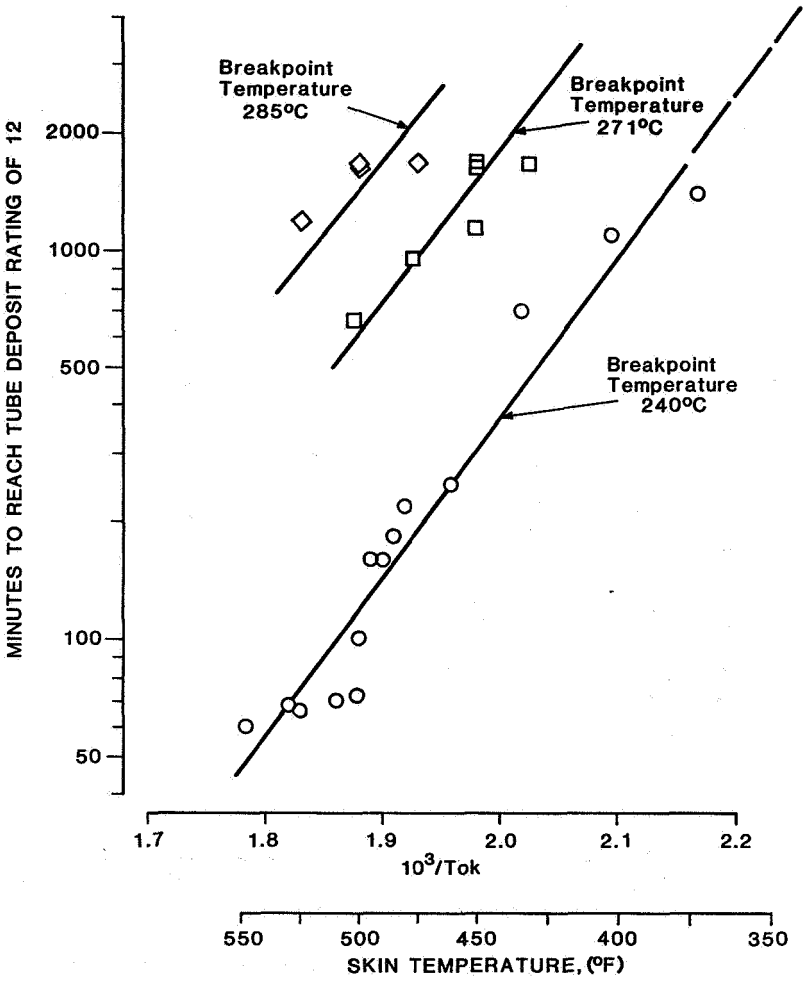


ALCOR JET FUEL THERMAL OXIDATION TESTER

NAPC



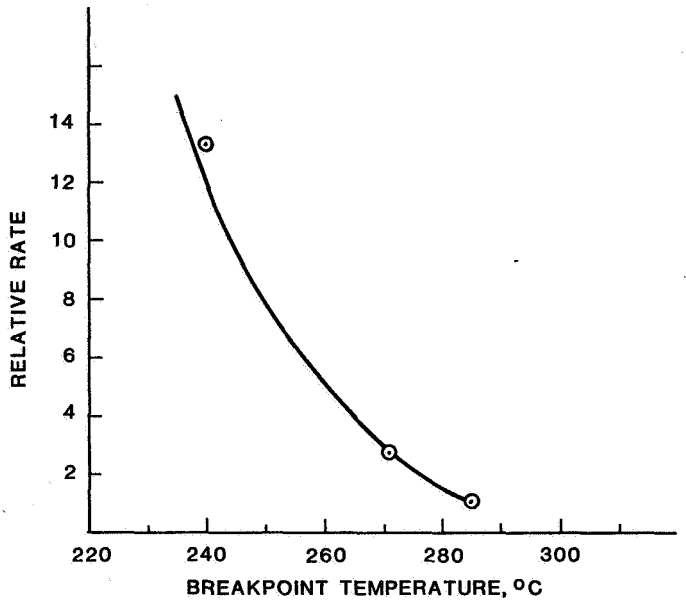
MODIFICATION OF THE ALCOR JFTOT



TIME (MINUTES) TO REACH TUBE DEPOSIT RATING OF 12
VS.
SKIN TEMPERATURE 10^3/Tok

FUEL	BREAKPOINT TEMP. °C (°F)	TIME (Min) TDR 12 AT 260°C	RELATIVE DEPOSIT FORMATION RATE
10% DFM/5P-5	240 (464)	120	13.33
JP-5	271 (520)	600	2.66
JP-5 (OIL SHALE)	285 (545)	1600	1.00

EXPERIMENTAL DATA



RELATIVE DEPOSIT FORMATION RATE AT 260°C
VS.
BREAKPOINT TEMPERATURE, °C