HYDROGEN PEROXIDE MONOPROPELLANT SYSTEMS

There are many variables to consider for a hydrogen peroxide monopropellant system, such as the initiating source and type (catalyst or thermal bed), injection technique, chamber configuration, hydrogen peroxide concentration, hydrogen peroxide inlet temperature, initial chamber temperature, exit pressure, etc., on the start transient. (The start transient is defined in these efforts as the time period from injection of hydrogen peroxide into the decomposition chamber to the achievement of 90-percent of the operating chamber pressure.)

In general, the start transient for a hydrogen peroxide catalytic monopropellant decomposition chamber normally ranges from 50 to 150 ms. This start transient is typical of all of the catalysts used in the decomposition of hydrogen peroxide concentrations ranging from 76 w/o (Ref. 1) to 98 w/o (Ref. 2, 3 and 4).

The greatest effect on this typical start transient is caused by variation in the hydrogen peroxide and/or catalyst bed temperature. Laboratory studies (Ref. 5) have demonstrated the lack of reaction between solid or super-cooled hydrogen peroxide and a typical catalytic material, while studies with actual engine catalyst beds (Ref. 3) have shown limited initiation of decomposition and excessive start transient periods when the temperature approaches the propellant’s freezing point. However, the low temperature start characteristics of various catalyst beds have been

improved through special design of the catalyst chamber and special treatment of the catalyst bed (Ref. 2, 3, and 4). Conversely, an increase in propellant or catalyst bed temperature (such as experienced in pulsing or other heat feedback operations) has resulted in start transients as low as 10 ms (Ref. 1, 2, 3, 4 and 6).

Although exit pressure has a slight effect on the start transient, this effect is usually within the ranges noted above and controlled by the temperature effects. Of course the start transients are affected by the catalyst life and generally are the best indication of the decline in catalytic effectiveness.

The start transients in a hydrogen peroxide thermal decomposition chamber are entirely related to the technique and configuration employed. Since this concept depends on the initial heating of a thermal pack prior to injection of the hydrogen peroxide, the start transient of the main hydrogen peroxide stream should approach the hot bed start transients (~ 10 ms) noted above. However, studies with both, 90 w/o (Ref. 2) and 98 w/o (Ref. 7) have indicated that adequate heating of the thermal pack may require periods ranging 500 ms to several minutes depending on the technique employed. Hypergolic slugs of hydrazine containing mixed cyanide salts (Ref. 2) have produced initial start transients (i.e., the period measured from injection of the hypergol) of 10 to 20 ms, but this technique required 300 ms hydrogen peroxide leads and 500 ms hypergol injection periods.

Source : http://www.diyspaceexploration.com/hydrogen-peroxide-monopropellant-systems/