Fuel degradation is one major concern in the development of the supercritical fuel combustion technology where, different to the conventional engine combustion technology, fuel is preheated to and injected at the supercritical state. Fuel degradation not only influences combustion efficiency but also causes significant engine failure. The major objective of this study is to gain a better understanding of degradation behavior of liquid transportation fuel (diesel fuel, biodiesel fuel, and diesel-biodiesel blends) in a broad range of temperature and residence time conditions. Thermal stressing experiments have been conducted to investigate the impacts of temperature, residence time and CO₂ on diesel fuel thermal stability. It was found that diesel fuel exhibited very good thermal stability up to 420 °C for a residence time of 30 min. As temperature increased above 420 °C, fuel degradation accelerated. At 400 °C, DF remained stable for 60 min. These results suggest that 400-420 °C is an optimal temperature range where supercritical fuel injection and combustion can work. It was also found that CO₂ was able to reduce solid deposit accumulation possibly due to enhanced solvent capacity. In additional, different morphologies and structures of solid deposits were observed. Studies on degradation of biodiesel and biodiesel-diesel blends are in progress, and results will be presented.