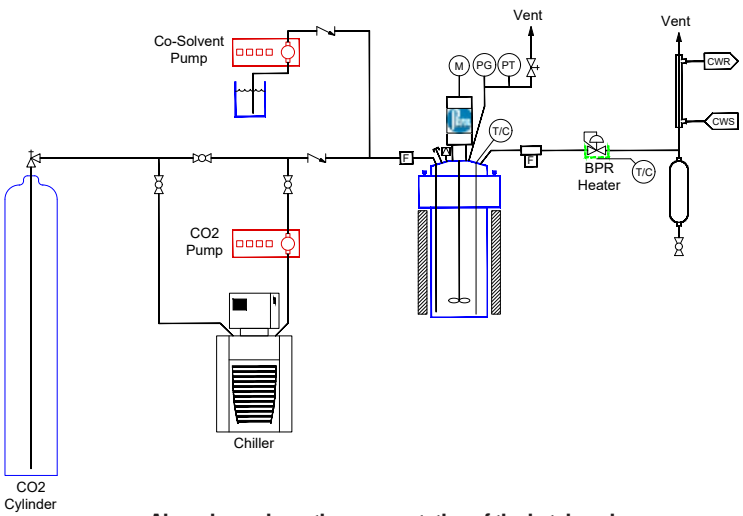
Supercritical Fluids

The 500 mL batch supercritical water extraction vessel pictured above is constructed of Hastelloy C-276 and is designed for use to 6000 psi (410 bar) at 400 °C.

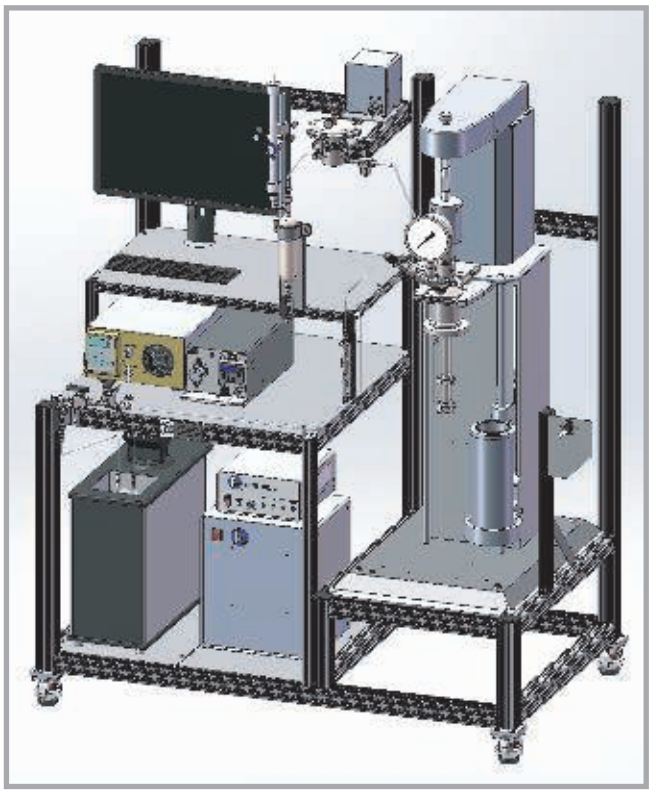
A supercritical fluid is any substance at a temperature and pressure above its critical point. Such fluids can diffuse through solids like a gas and dissolve materials like a liquid. Near the critical point, small changes in pressure or temperature result in large changes in density, allowing many properties of a supercritical fluid to be "fine-tuned". Supercritical fluids are often suitable substitutes for organic solvents in a range of industrial and laboratory processes.

Carbon dioxide is one of the many commonly used supercritical fluids. It is relatively simple to exceed its critical point (31 °C, 1057 psi). Applications that involve supercritical fluids include extractions, nano-particle and nano-structured film formation, supercritical drying, carbon capture and storage, as well as enhanced oil recovery studies. Parr has provided systems for all the aforementioned applications.

Water is another substance that is often used in its supercritical condition (374 °C, 3185 psi). Its excellent thermal conductivity properties make it the fluid of choice in pressurized nuclear reactors for electricity generation. The extremely aggressive and reactive nature of supercritical water makes it an excellent choice for the oxidative destruction of some hazardous waste materials. This corrosive nature prohibits the use of T316 stainless steel for the vessel and requires the use of a special alloy.



Above is a schematic representation of the batch carbon dioxide extraction system shown at the right.



This batch carbon dioxide extraction system modelled above includes a 1.2 L extraction vessel rated to 5000 psi (345 bar), both CO_2 and co-solvent pumps, automatic pressure control and collection vessel with manual ball valve for extract collection, as well as custom control and data logging system with pre-programmed recipe list.