Particle formation
Hygienic design
Numerous processes with supercritical CO₂ have been developed which allow the generation or modification of fine particles with defined particle size distributions in micro- and even nano-scale of certain shape and/or determined morphology. This new technology is of highest relevance to generate pharmaceutical products and substances. The dosing and release properties of active pharmaceutical ingredients (APIs) are significantly influenced by the particle properties. New drugs with exact and controlled properties will be possible in the near future by using these new processes complementing traditional granulation and spray drying processes.

**Advantages of supercritical processes**
- Size: micro- to nanometer
- Narrow size distribution adjustable
- Control of geometry (spherical, needle, etc.)
- Morphology (smooth, porous, massive) controllable
- Applicable to difficult substances, for example with high melting points or high viscosity
- No thermal stress due to mild temperature conditions
- No oxidation due to inert atmosphere
- Possibility of generation of composites
- CO₂ acting as germicide

**Characteristics of high pressure micronisation:**
- Physical characteristics when applying supercritical fluids to melts/solutions:
  - Reduction of viscosity
  - Reduction of surface tension
- Quick super-saturation by pressure change and contact to supercritical fluid, respectively
- High nucleation rate, small growth rate
- Particles in micro- or nano-scale possible

**Components and plants for particle design**
While standard supercritical extraction equipment is suitable for foods, the pharmaceutical industry has higher requirements concerning materials, surfaces, prevention of dead space, cleanability, process controls documentation and others.

Uhde High Pressure Technologies has developed hygienic high pressure pipe fittings and valves, modified experienced equipment like the clamp closure system for high pressure vessels and uses innovative manufacturing procedures like orbital welding of pipes.

Plants are designed to allow easy draining of the process fluids. CIP and WIP features can be implemented.

Design, manufacturing and documentation of plants will be carried out according to current Good Manufacturing Practice (cGMP).

Pharmaceutical plants from Uhde High Pressure Technologies fulfill all demands on FDA, EMEA, cGMP, GAMP etc. SPS, SCADA and visualization fulfill the requirements of 21 CFR Part 11, GAMP.