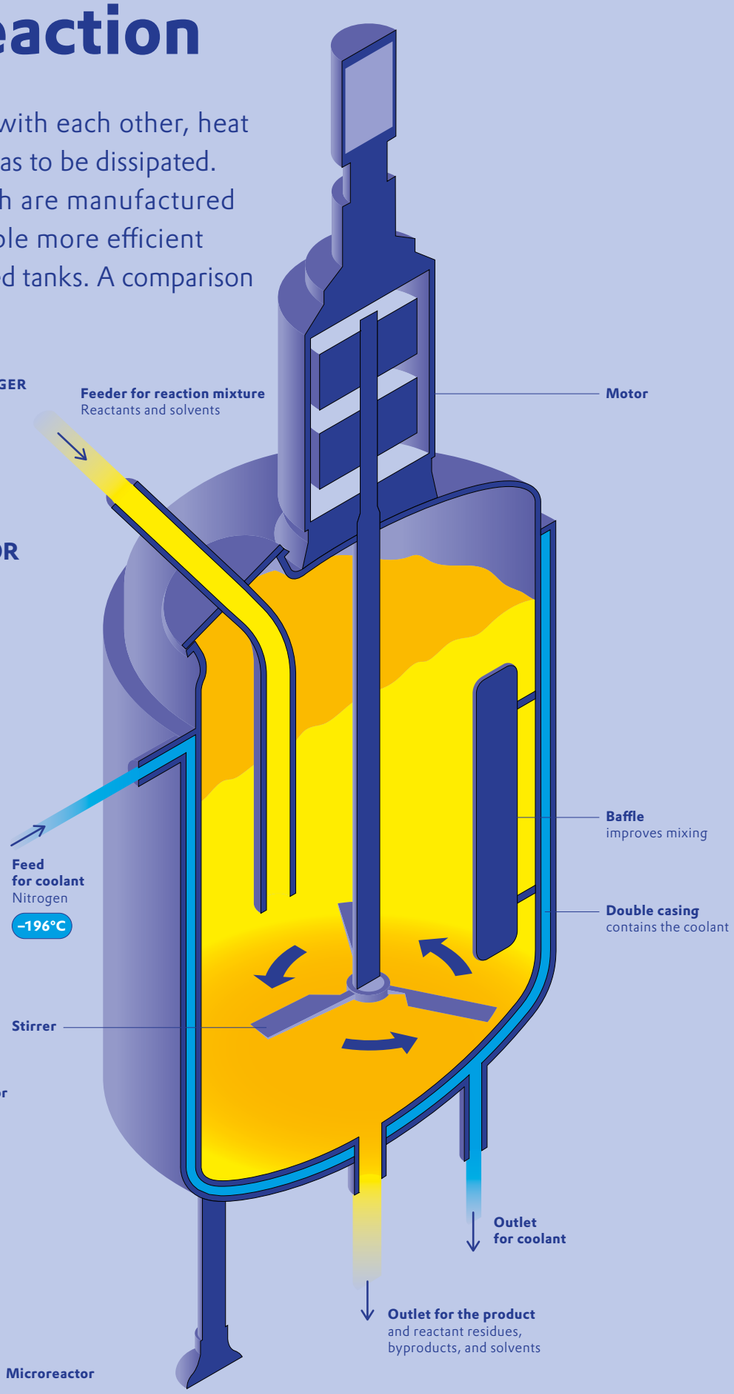
A cool reaction

When chemicals react with each other, heat is often generated and has to be dissipated. Small flow tanks, which are manufactured using 3D printing, enable more efficient cooling than classic stirred tanks. A comparison of the two systems

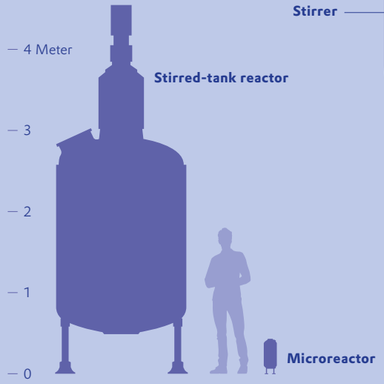
INFOGRAPHIC **MAXIMILIAN NERTINGER**

STIRRED-TANK REACTOR

The large reactor volume generates a lot of heat. A very cold coolant (nitrogen at -196°C) has to be pumped through the reactor casing to ensure that no part of the tank gets too hot.



Size comparison



Comparison of the efficiency of the reactor types*

Microreactor Stirred-tank reactor

Energy consumption in MWh

54

310

□ = ø annual electricity consumption of 100 German households: **310**
Source: destatis.de

CO_2 emissions in t

31

100

□ = CO_2 emissions of an Airbus A320 on a flight from Munich to Berlin: **37**
Source: atmosfair.de

Space needed in m^2

10

100

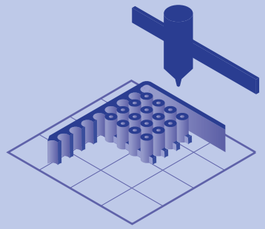
*Relative to the cooling requirement for a production volume of 150,000 tons per year for ortho-lithiation

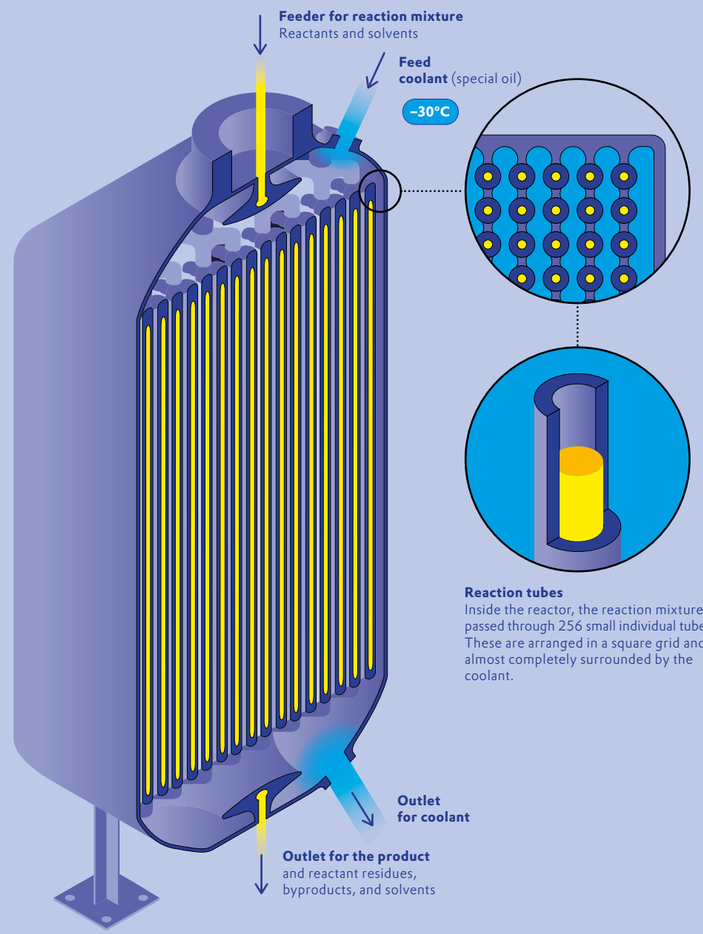
MICROREACTOR

Many thin reactor tubes ensure that the local temperature stays lower. Because all the tubes are surrounded by a cooling medium, the heat is also better dissipated.

New production process

3D printing enables reactor components to be manufactured in shapes that would be very expensive to make using conventional production processes such as injection molding.





Reaction tubes
Inside the reactor, the reaction mixture is passed through 256 small individual tubes. These are arranged in a square grid and are almost completely surrounded by the coolant.