

# Development of the "5.3 subgroup" of Standards for solving of inventive problems

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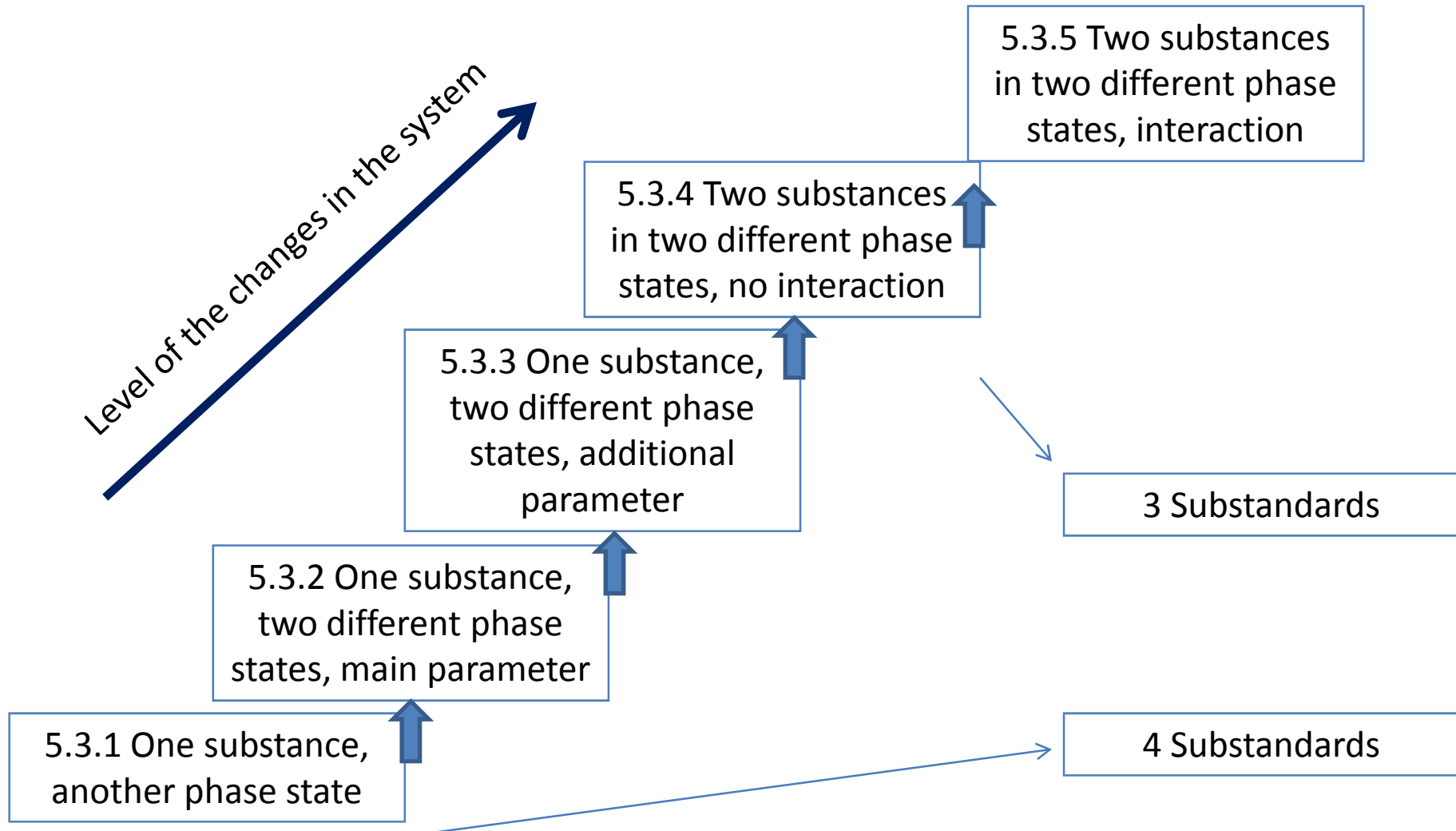
# Standards

for solving of inventive problems. Subgroup 5.3

## Subgroup 5.3. Use of phase transitions

- 5.3.1. The change of the phase state of substance
- 5.3.2. Use of one substance with two phase state
- 5.3.3. Use of phenomenon which accompany the phase transition
- 5.3.4. Use of two substances with different phase states
- 5.3.5. Use of interaction between two substances with different phase states

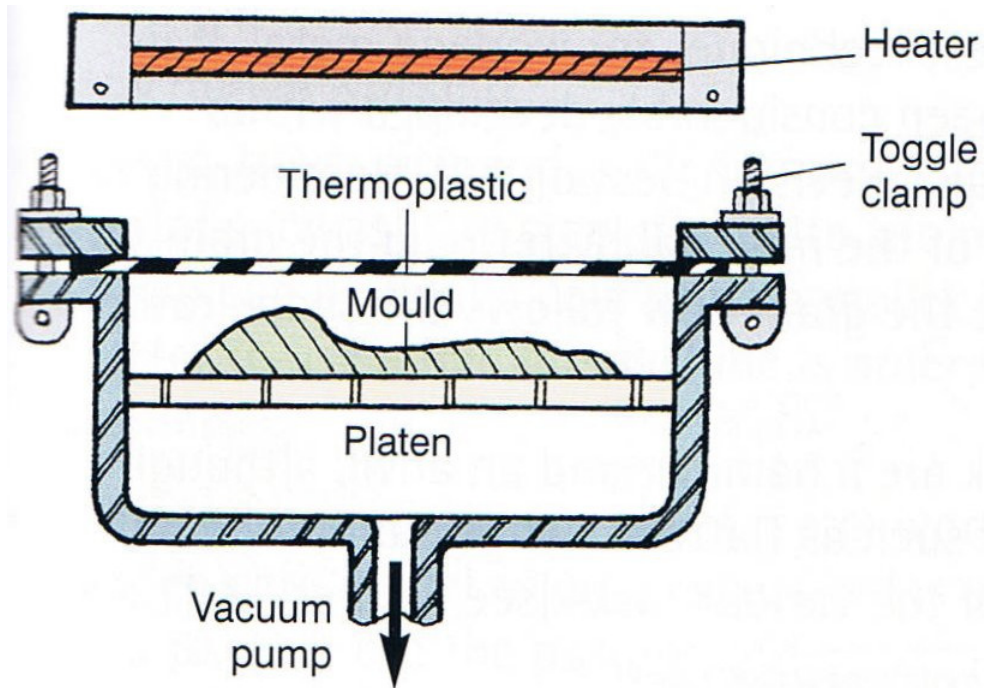
# Hierarchy of standards



# Standard 5.3.1 The change of the phase state of substance

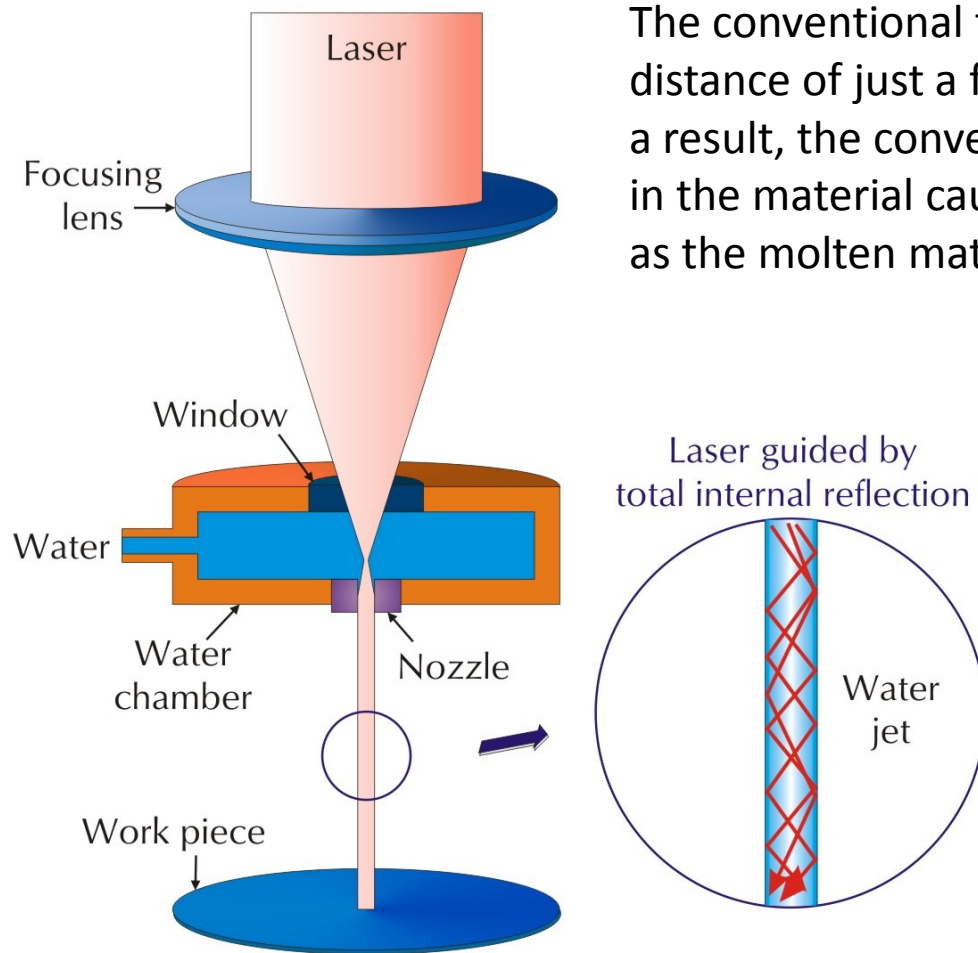
- Substandard 5.3.1.1 The change of the phase state of Tool
- Substandard 5.3.1.2 The change of the phase state of Transmission
- Substandard 5.3.1.3 The change of the phase state of Energy Source
- Substandard 5.3.1.4 The change of the phase state of Product

# Substandard 5.3.1.1 The change of the phase state of Tool



Vacuum forming is a technology that uses air instead of solid tool

# Substandard 5.3.1.2 The change of the phase state of Transmission



The conventional focused laser beam has a limited working distance of just a few millimeters due to beam divergence. As a result, the conventional laser generates a heat-affected zone in the material causing damage. Contamination is also an issue as the molten material is not expelled.

Utilizing the difference in the refractive indices of air and water, the technology behind Laser MicroJet® creates a laser beam that is completely reflected at the air-water interface. The beam can be guided over a distance up to 10 cm. Unlike conventional laser cutting where thermal distortion is a problem, the cut is cooled by the water jet between laser pulses, producing what is effectively “cold laser cutting.”

# Substandard 5.3.1.3 The change of the phase state of Energy Source



SpaceShipTwo hybrid rocket engine uses solid and liquid fuels





# Substandard 5.3.1.4 The change of the phase state of Product

- Well known example is the casting
- The most interesting example is the processing of metal at the superplasticity phase



## Standard 5.3.4 Use of two substances with different phase states

- Substandart 5.4.3.1 To add the second phase into the element of the technical system. The main function will be divided between these two phases.
- Substandart 5.4.3.2 To add the second phase into the element of the technical system. New phase will perform an additional function.
- Substandart 5.3.4.3 To use bi-phase element of the technical system. The first phase performs the main function, the second performs the transport function.

# Substandart 5.4.3.1

To add the second phase into the element of the technical system. The main function will be divided between the two phases

Typical concrete mixes have high resistance to compressive stresses; however, any appreciable tension will break it. If a material with high strength in tension, such as steel, is placed in concrete, then the composite material, **reinforced concrete**, resists compression but also bending, and other direct tensile actions. A reinforced concrete section where the concrete resists the compression and steel resists the tension can be made into almost any shape and size.



# Substandart 5.4.3.2

To add the second phase into the element of the technical system. New phase performs an additional function

*P. Schossig et al. / Solar Energy Materials & Solar Cells 89 (2005) 297–306*

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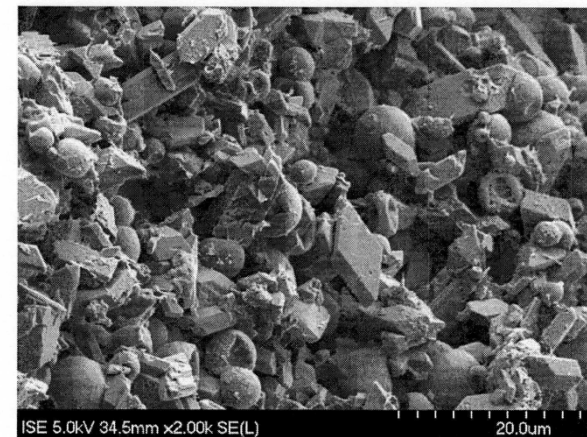
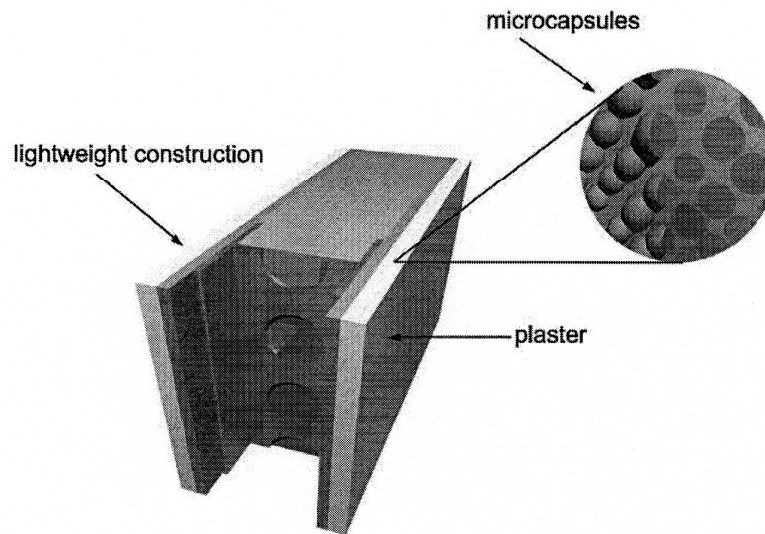


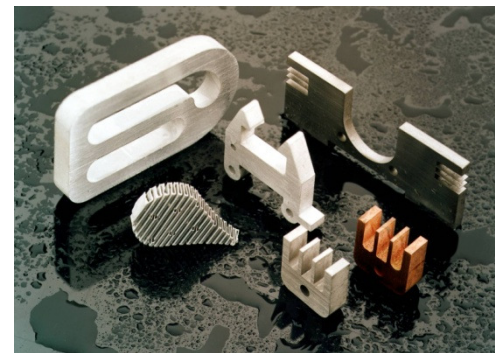
Fig. 2. SEM image of PCM micro-capsules in gypsum plaster. The PCM micro-capsules with an average diameter of 8  $\mu\text{m}$  are homogeneously dispersed between the gypsum crystals.

Fig. 1. Schematic view of a lightweight wall. The PCM micro-capsules are integrated into the interior plaster.

# Substandart 5.4.3.3

To use bi-phase element of the technical system. The first phase performs the main function, the second performs the transport function.

Abrasive-waterjet cutting uses a mixture of water and abrasive. The water performs transport function, the abrasive cuts metal.



**Thank You!**