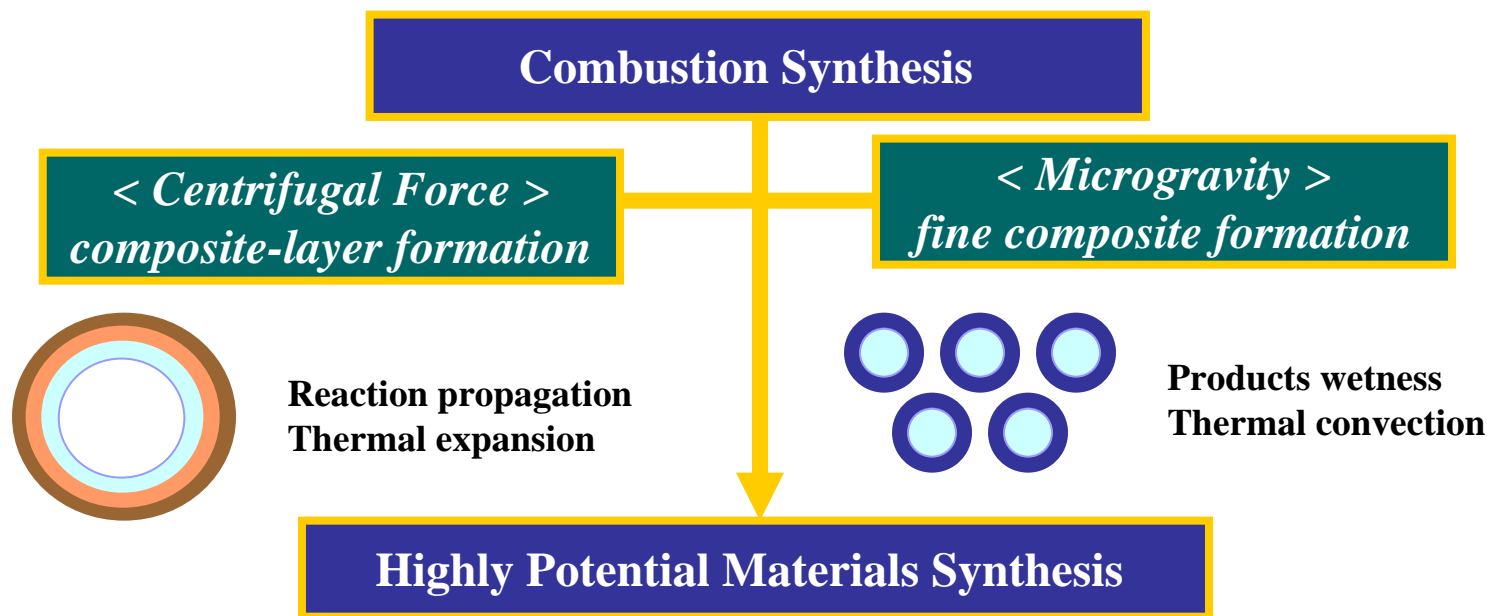


Functional Compound Combustion Synthesis under Centrifugal Force and Microgravity

Osamu Odawara

Dept. Innovative & Engineered Materials, Tokyo Institute of Technology
E-mail: odawara.o.aa@m.titech.ac.jp



Centrifugal-Thermite Process

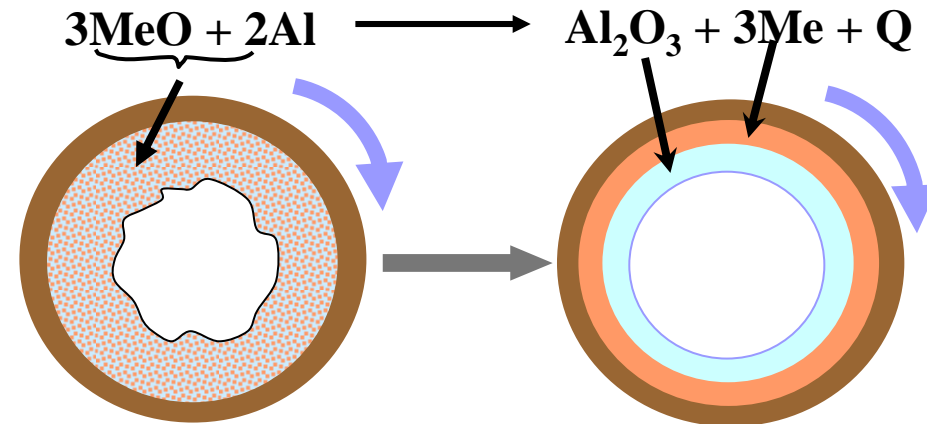
For casing pipes *on geothermal energy utilization*

For pipes *against erosion-corrosion*

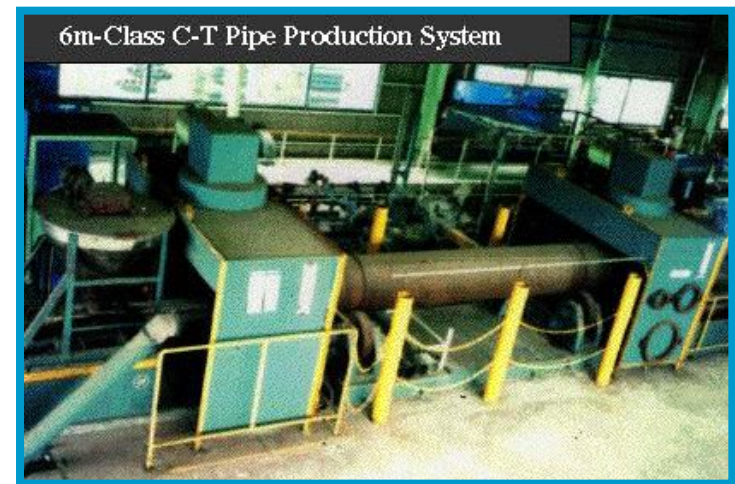
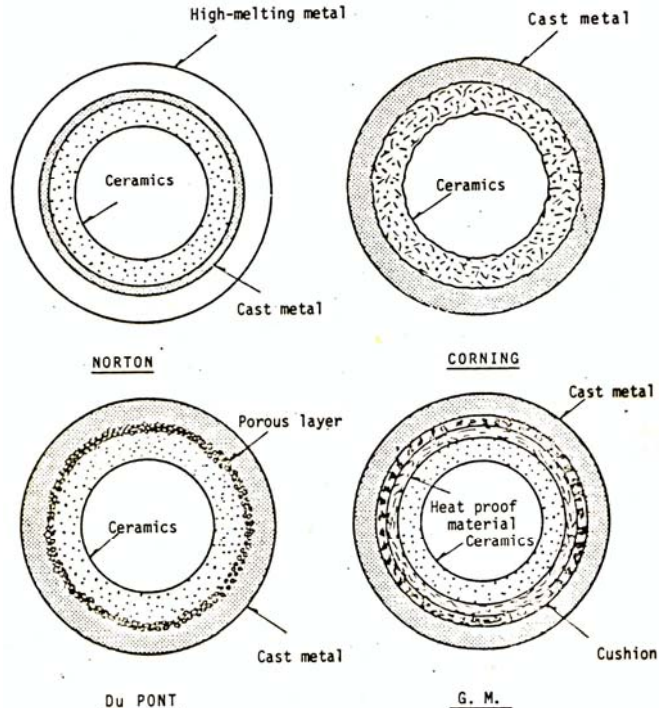
Centrifugal force applied for forming
composite layered pipes
(*Centrifugal-casting* technology)

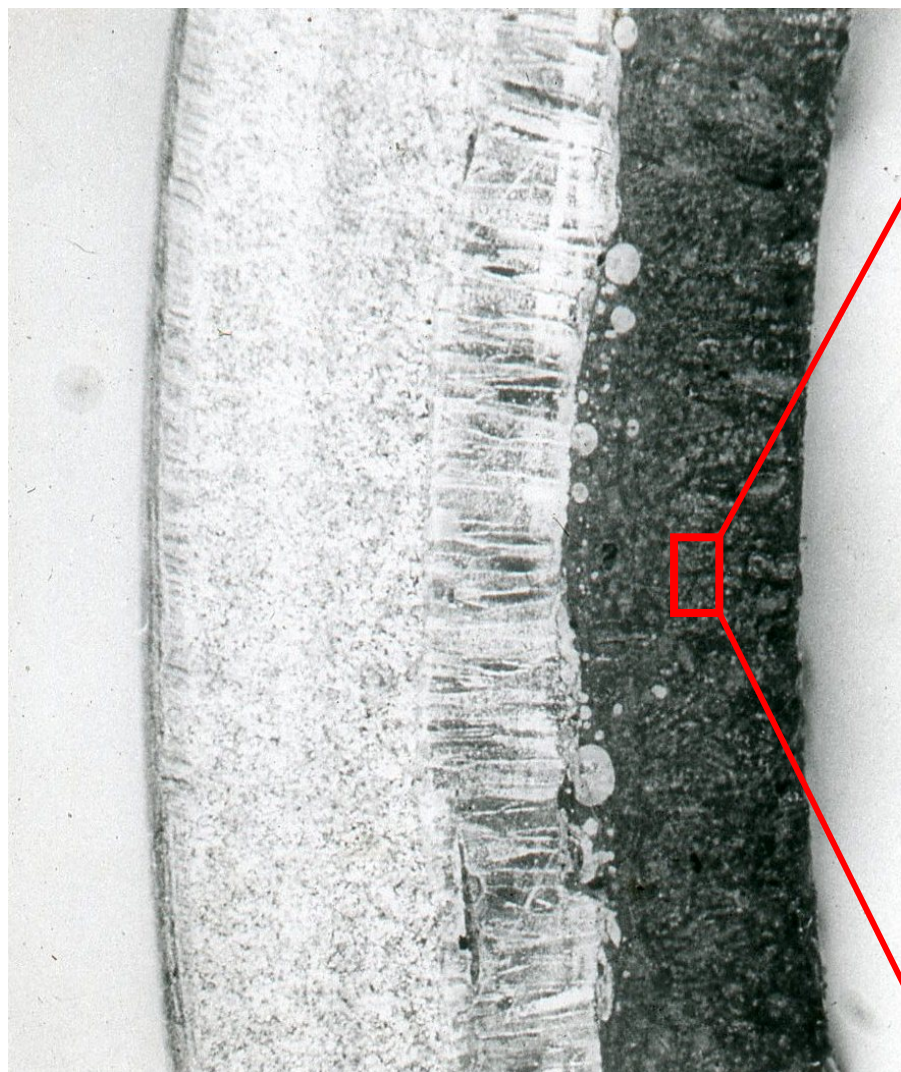
+

Thermite reaction achieving for
self-sustaining high-temperature reaction



30 mm ϕ x 100 mm \sim 500 mm ϕ x 6,000 mm





Outer metal layer

metal

ceramic

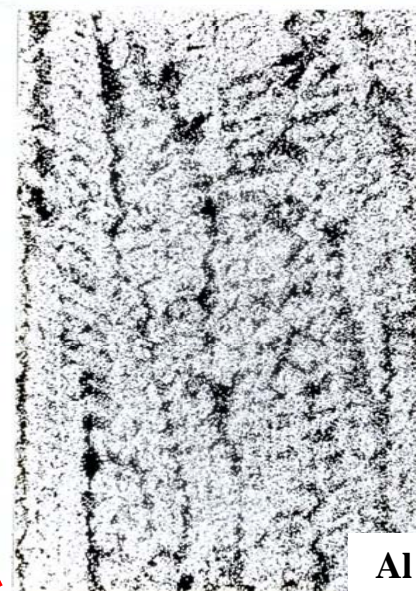
Product layers



SEI



BEI



Al

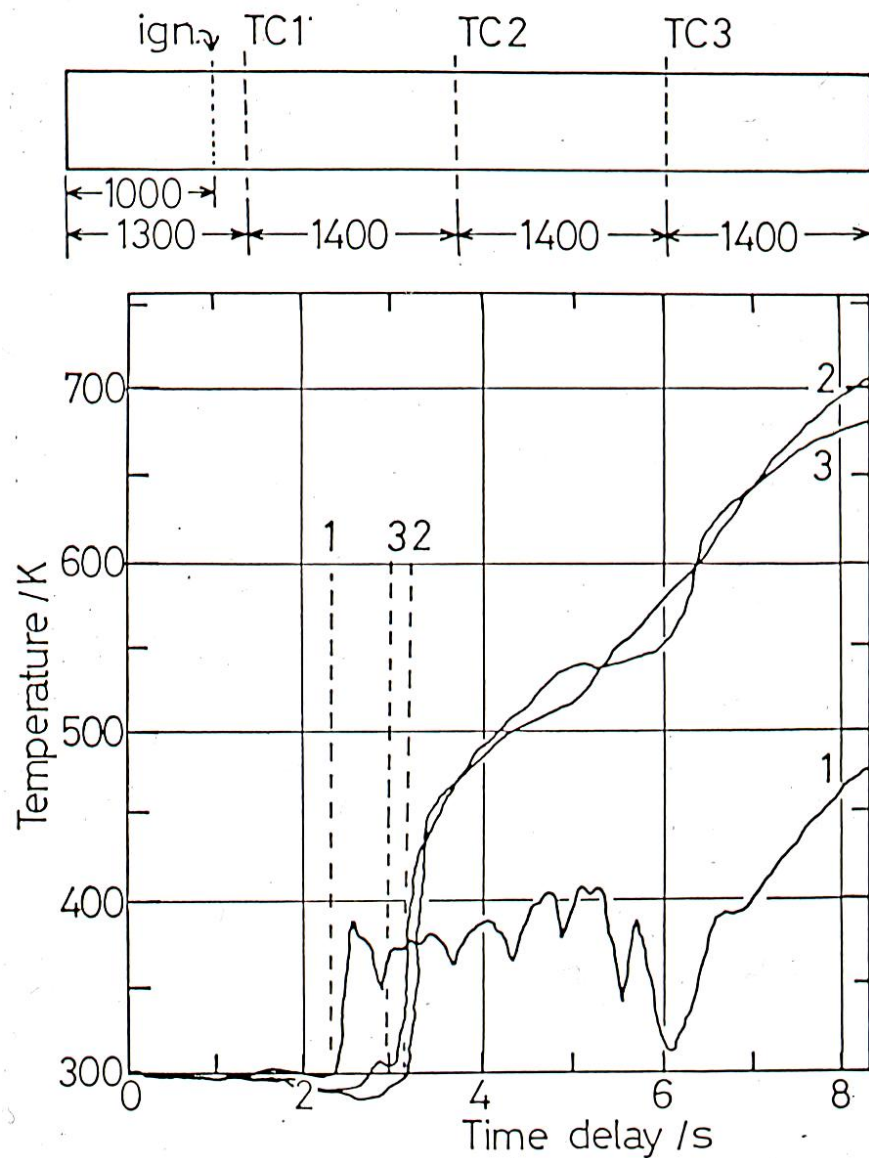
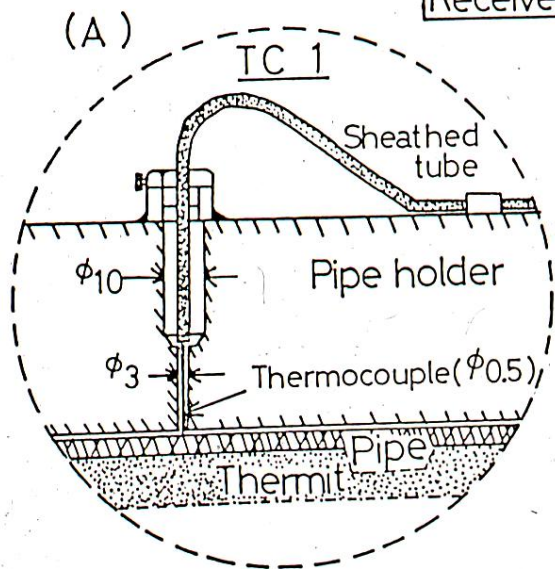
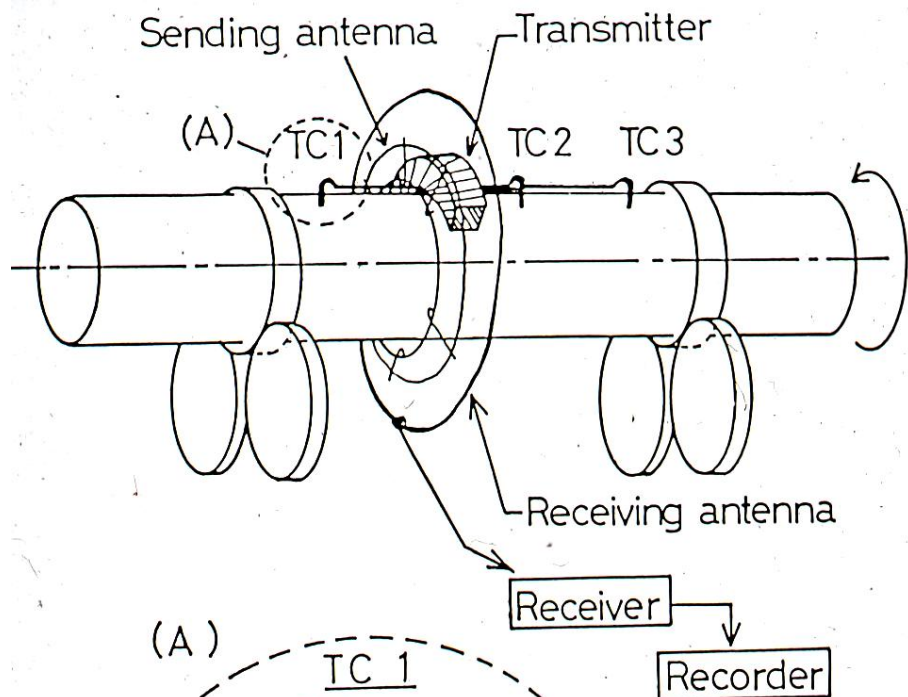


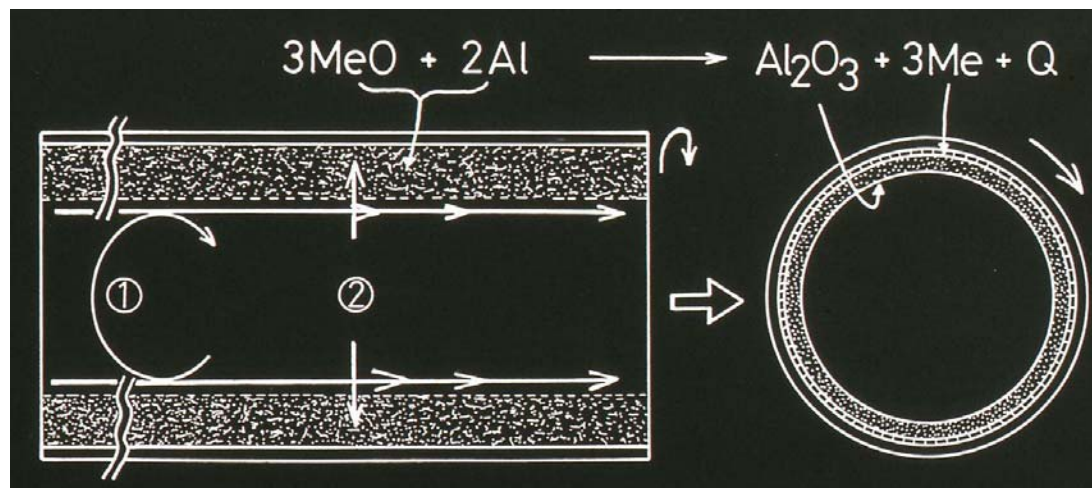
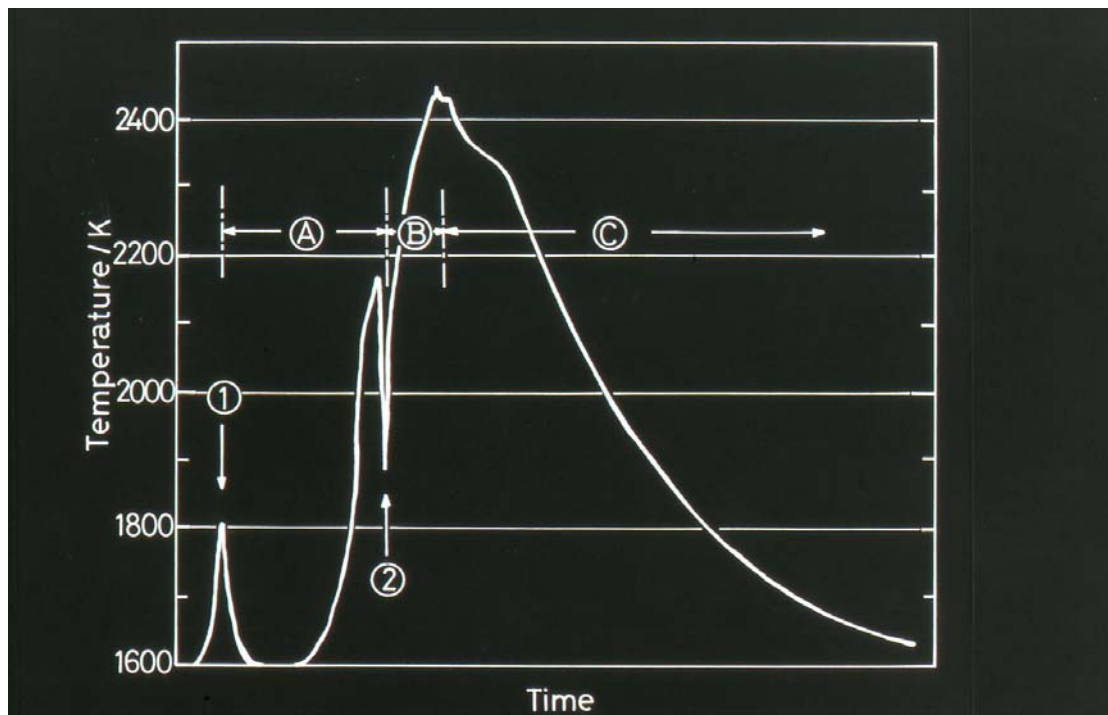
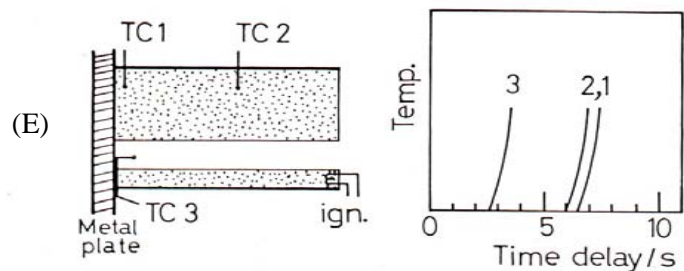
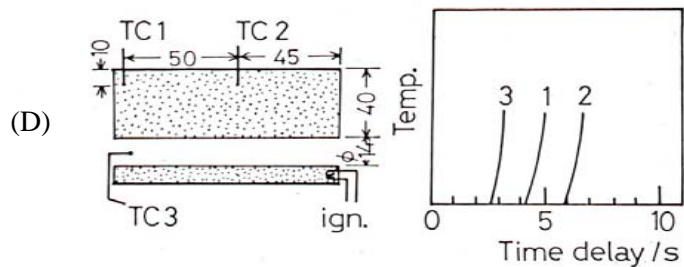
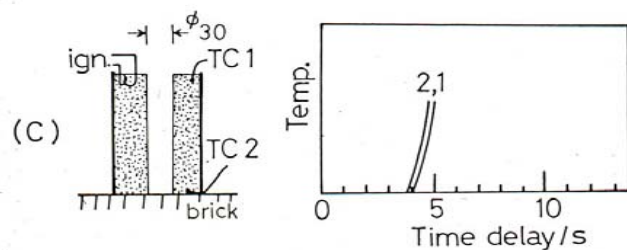
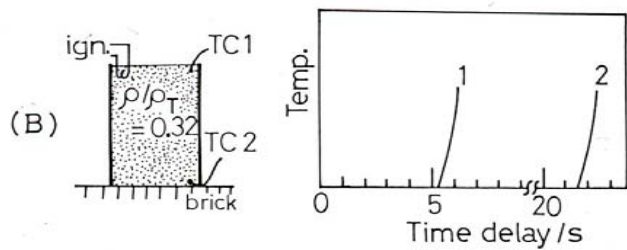
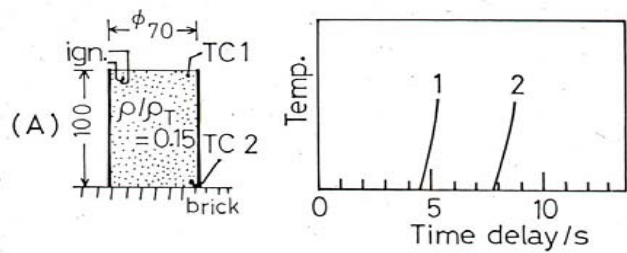
Fe

100 μ m









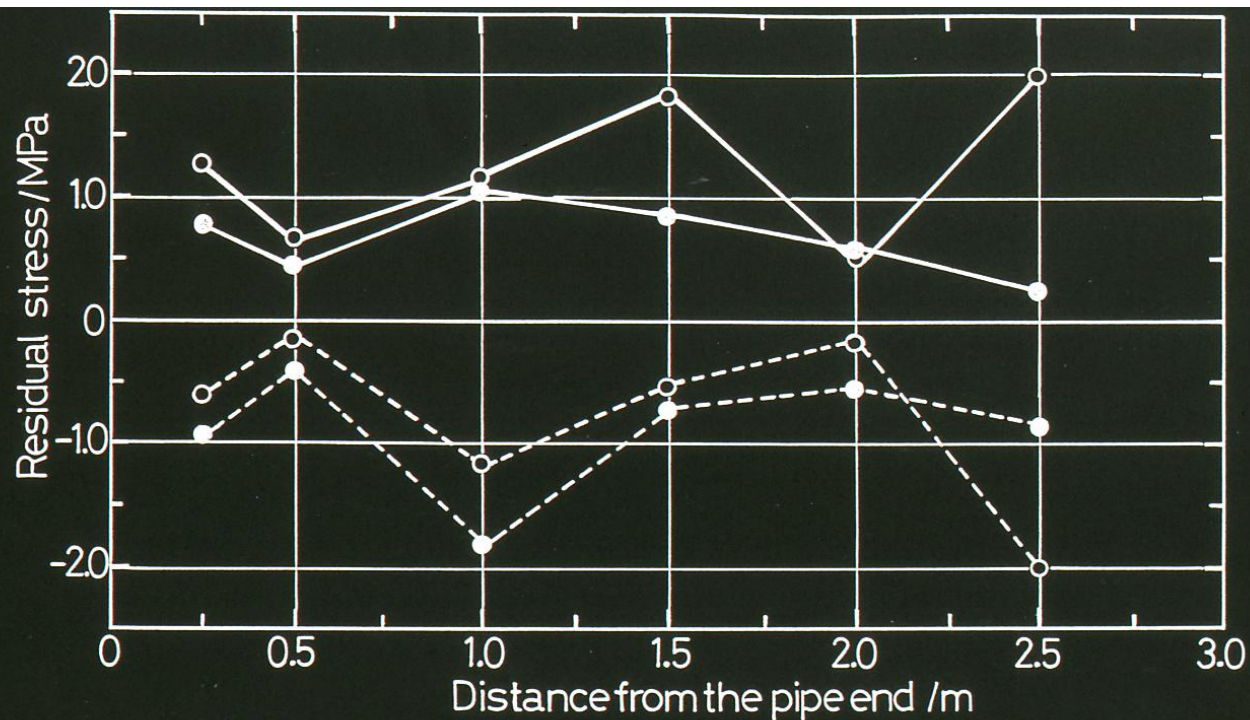
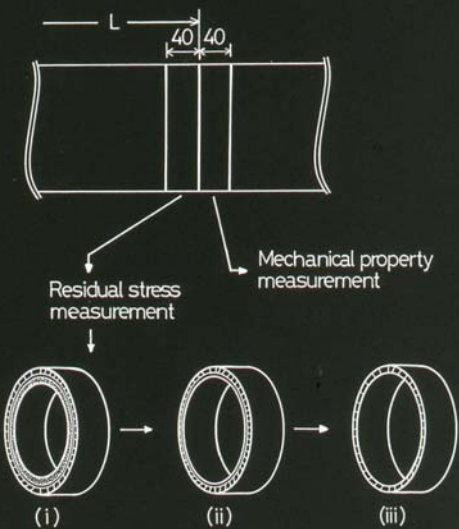


Fig. Residual stress of the outer steel pipe measured with a strain gauge
(Positive values refer to tension)

○ ; in the direction of pipe length, ● ; in the arc direction of pipe circumference.
— ; when ceramic layer is taken off, ---- ; when intermediate metal layer is taken off.

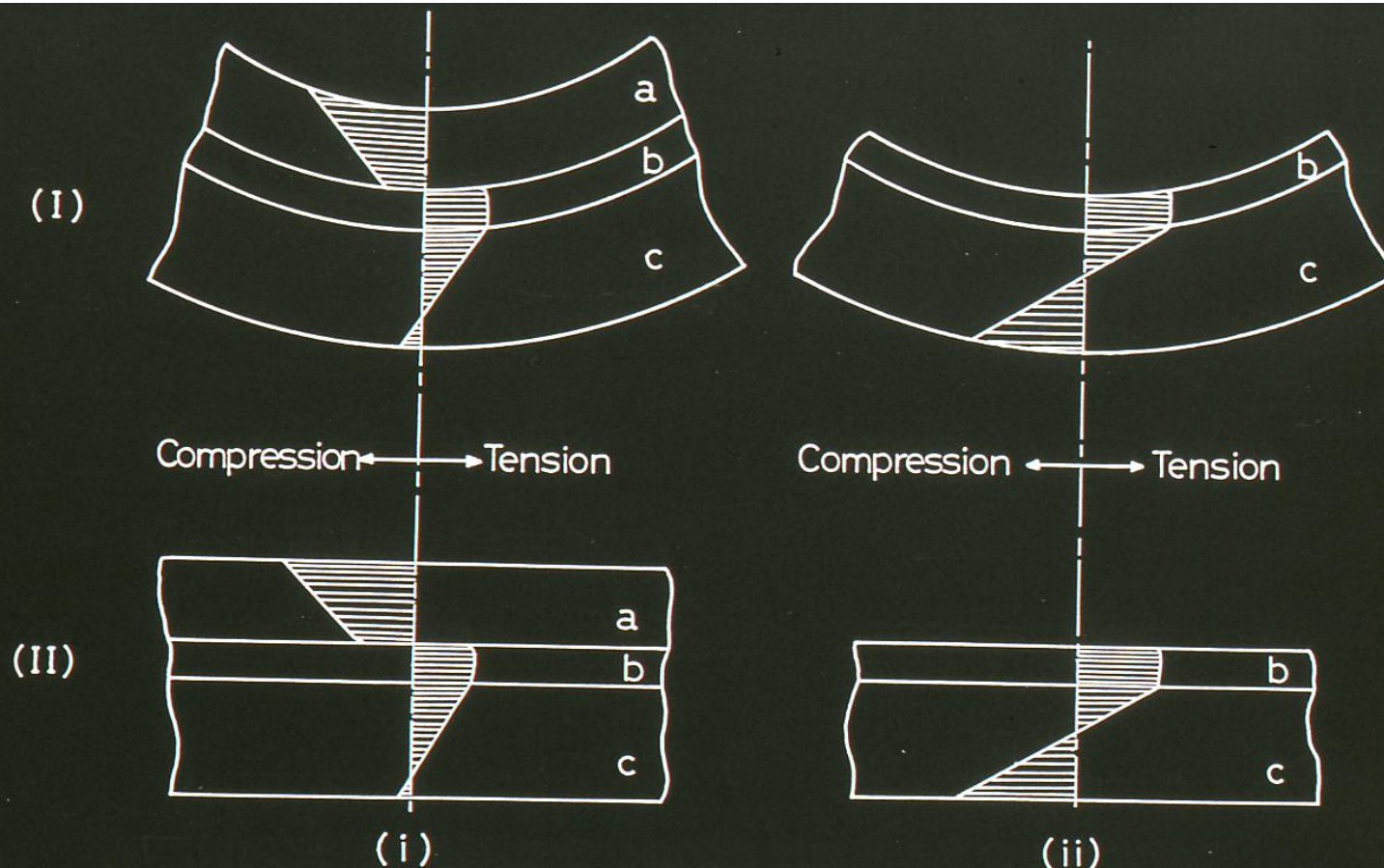


Fig. Schematic illustration of an estimated distribution of residual stress in each layer formed by the present C-T process.

a; ceramic, b; metal, c; outer steel pipe

(I); in the arc direction of pipe circumference, (II); in the direction of pipe length.

(i); with ceramic layer, (ii); without ceramic layer. . .



Functionally Graded Materials Project

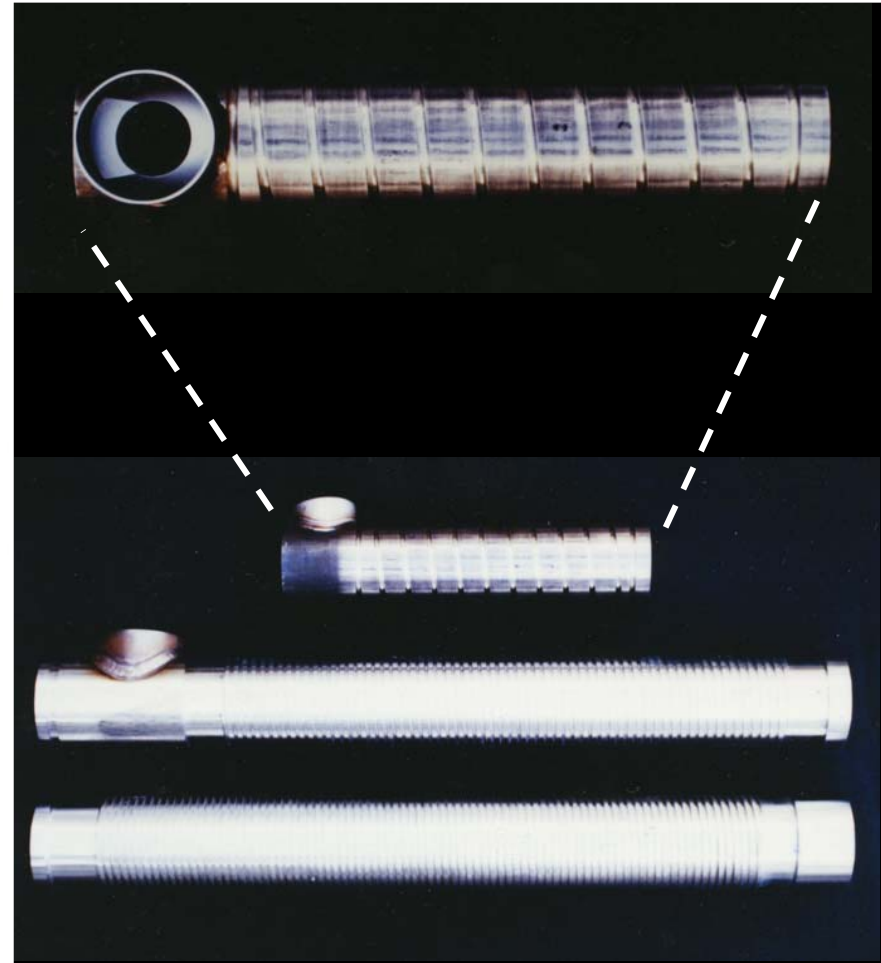
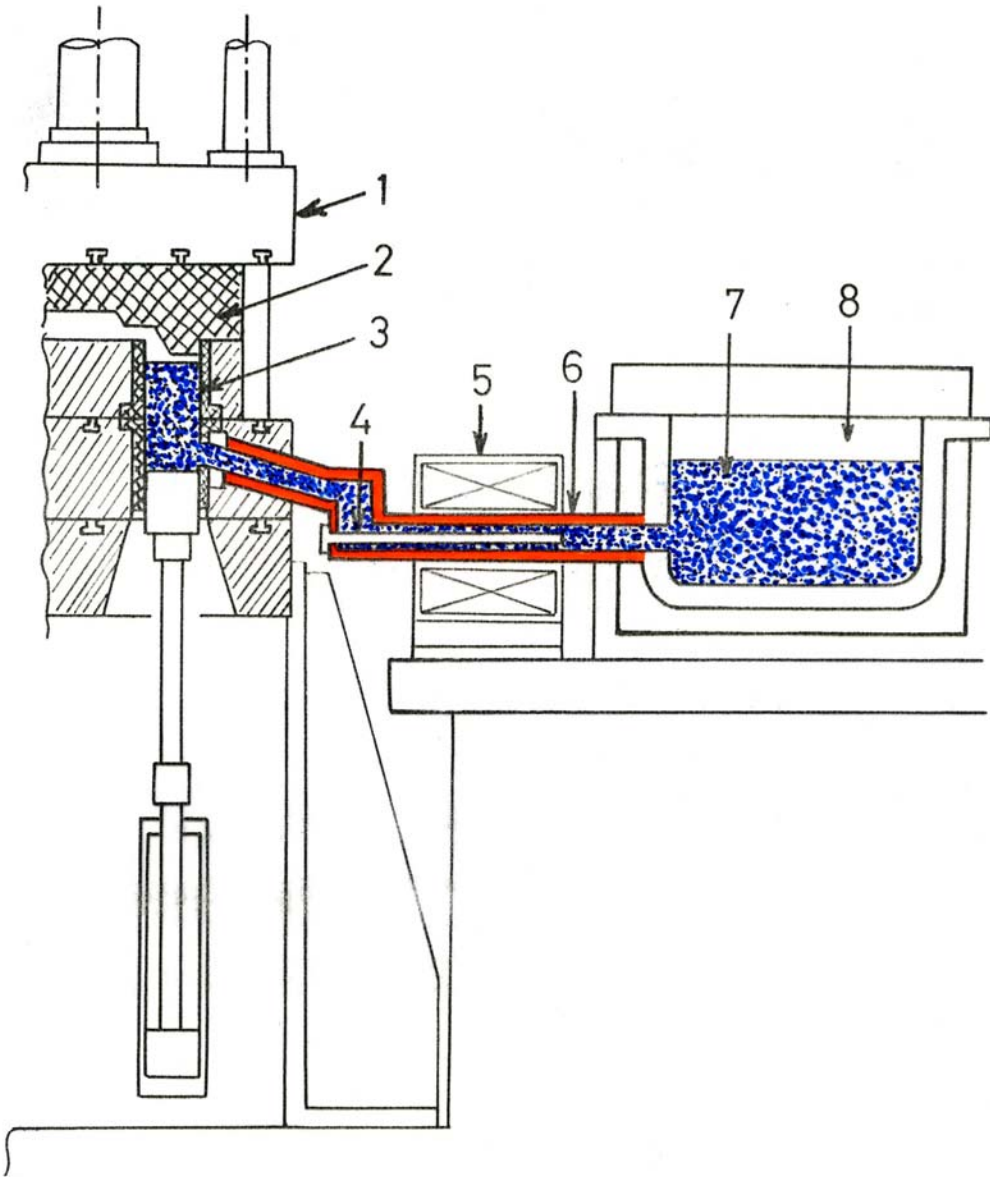
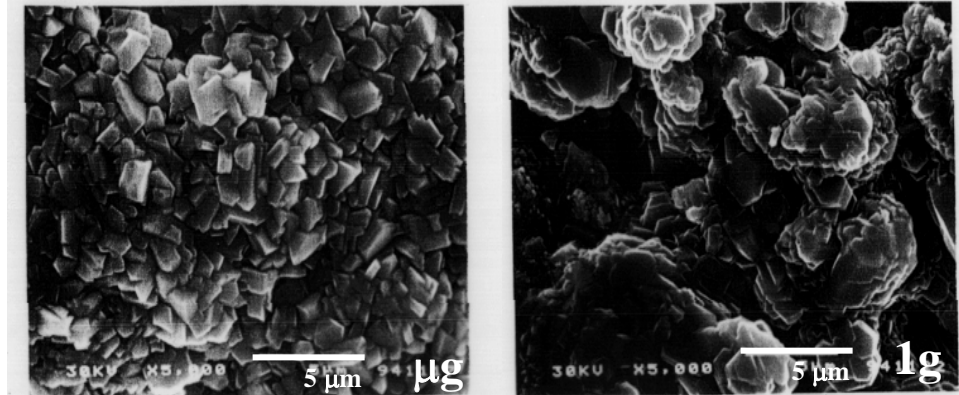
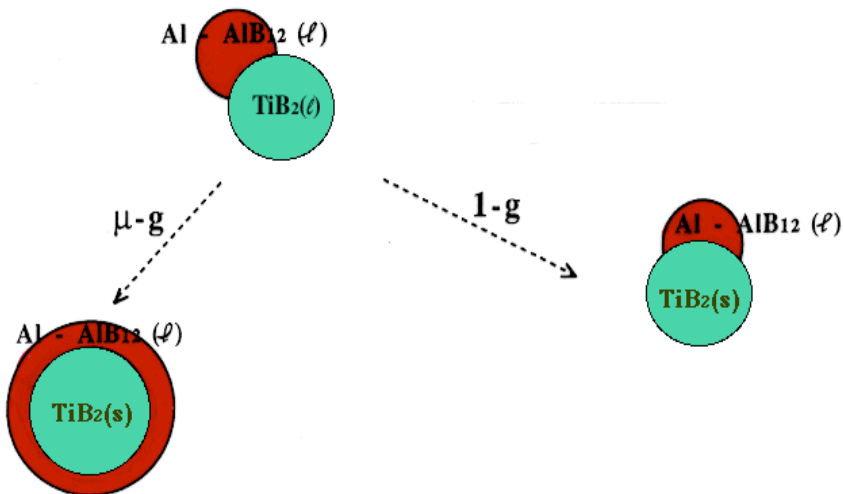
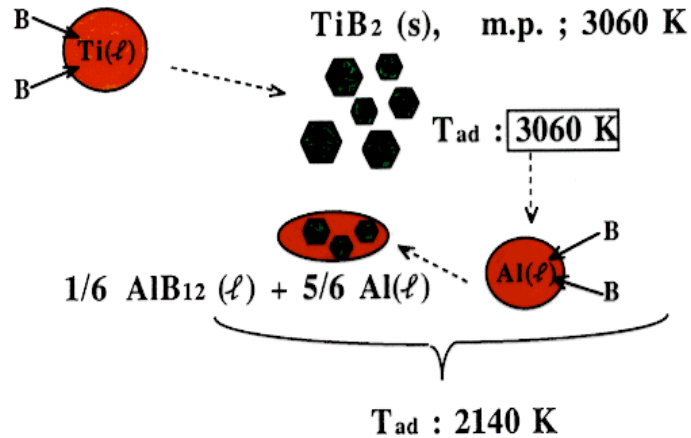


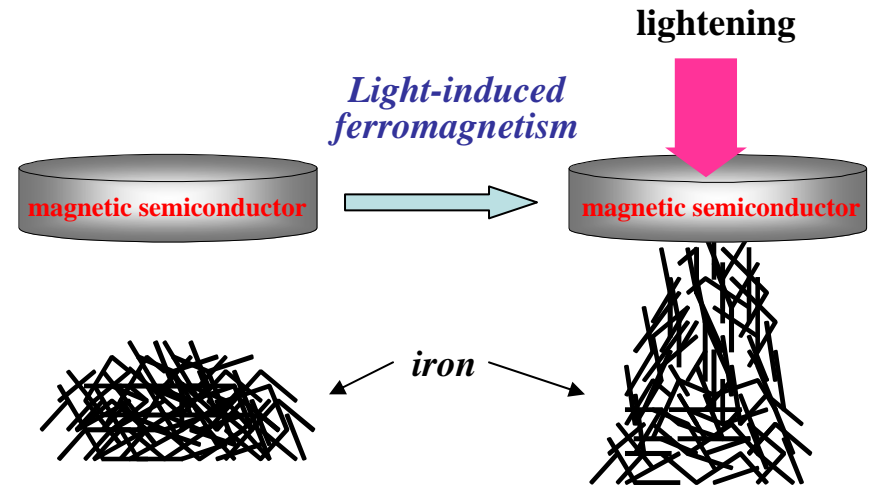
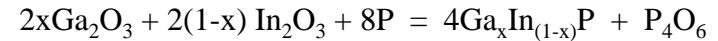
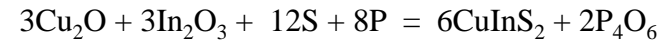
Fig. Schematic design of a medium pressure die casting process.

1; casting machine, 2; mold, 3; cylinder, 4; core,
5; electro-magnetic pump, 6; C-T pipe as a duct and a nozzle,
7; molten aluminum, 8; electric furnace

Micro-gravitational Combustion Synthesis



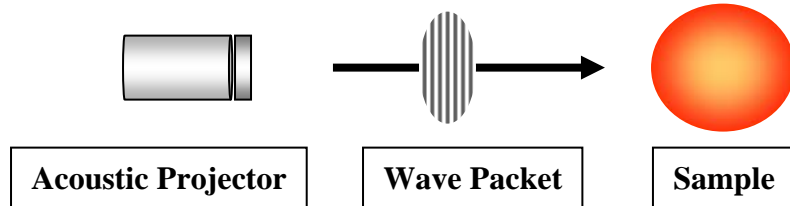
Optoelectronic compounds: GaP, InP and CuInS₂



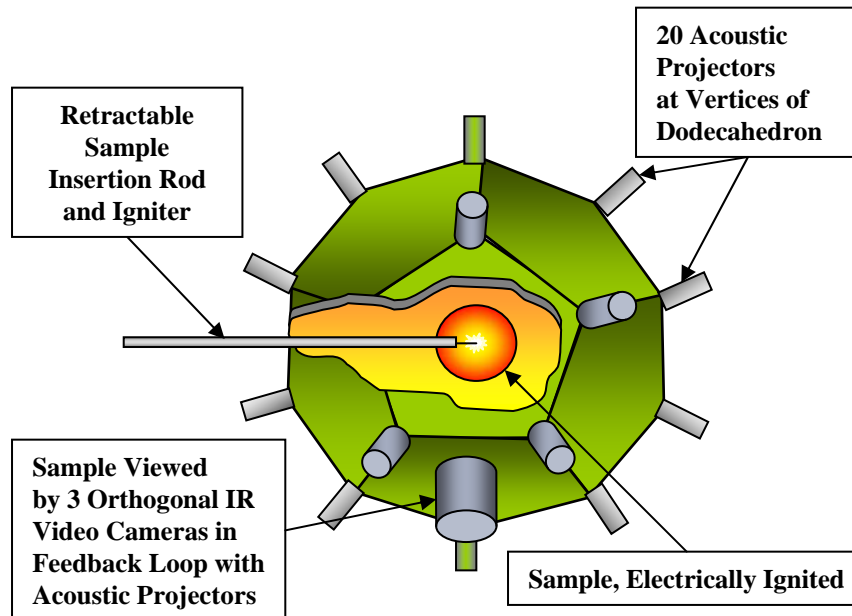
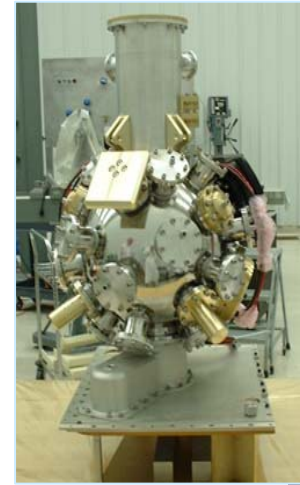
Dilute magnetic compounds: Mn-InP and Mn-(Ga, In)P

Space-DRUMS *Space-D*ynamically *R*esponding *U*ltrasonic *M*atrix *S*ystem

Dynamic Acoustic



- Short, Shaped, Ultrasonic Acoustic Pulses Projected at Sample
- Acoustic Beam Focused by Shaped Transducer
- Reflecting Wave Packet Transfers Momentum to Sample
- Pulses Digitally Controlled by Video Cameras in Feedback Loop



[Activity Plan of Space Combustion Synthesis Working Group]

