Control of Manufacturing System・PID・Adaptive Control

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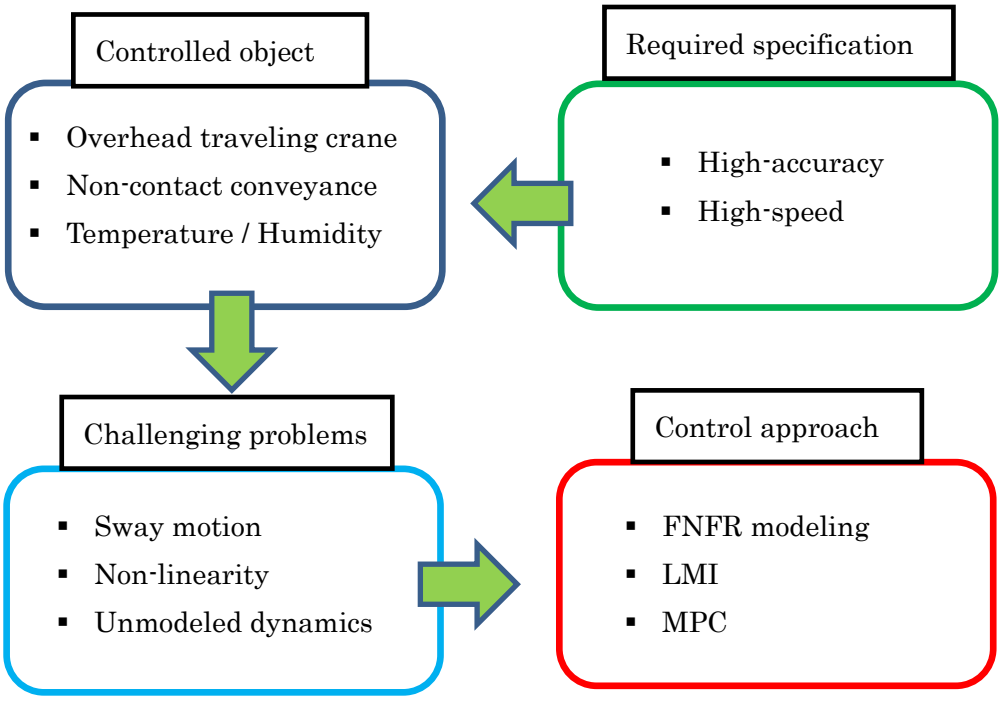
Academic Society and Association	The Japan Society of Mechanical Engineering, The Society of Instrument and Control Engineering		
Research Keywords	Motion control, Programmable Logic Controller, PID Control, Adaptive Control		
Technical Fields and Topics possible for collaboration	▪ Manufacturing control system by using programmable logic controller ▪ Magnetic levitation control ▪ Temperature and humidity control ▪ Sound and vibration control		

Details of the Research Theme

The recent interest is control of the manufacturing system, such as “Overhead traveling crane”, “High-speed motion control”, Temperature and humidity control” by using Programmable Logic Controller (PLC). High accuracy conveyance control system without sway motion is required to achieve high-efficiency of crane motion control. Non-linearity and higher-order unmodeled dynamics can be challenging problems. The effectiveness has been confirmed by experimentation of “Non-contact conveyance by using Magnetic Levitation (MagLev) control system. The controller of the system was designed by applying the new control designing method; Finite Number Frequency Response (FNFR) modeling technique and Linear Matrix Inequality (LMI) method to cope with the difficulty of the modeling of controlled object. On the other hand, temperature and humidity control are also strongly required in many manufacturing systems. However, they are only controlled separately by PID controller in the current automation factory. One of the non-linear control systems, which is “Model Predictive Control (MPC)” system is useful control method for the temperature and humidity simultaneous control system. The brand-new PLC, “Sysmac NJ” produced by OMRON corporation is adopted to implement the control system because Sysmac NJ has the special function which can use the controller designed by MATLAB / Simulink.



Material Production by Combustion Synthesis

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Academic Society and Association	The Japan Society of Mechanical Engineers, Combustion Society of Japan		
Research Keywords	Combustion synthesis, Self-propagating High-temperature Synthesis, Flame synthesis		
Technical Fields and Topics possible for collaboration	▪ Material production by SHS ▪ Flame synthesis of diamond film		

Details of the Research Theme

Combustion synthesis can produce various useful materials with rapidity and at a low cost. More than 500 kinds of materials, including carbides, borides, silicides, nitrides, intermetallics, and complex composites, can be synthesized by the combustion synthesis method. Diamond films can also be produced by flame synthesis method.

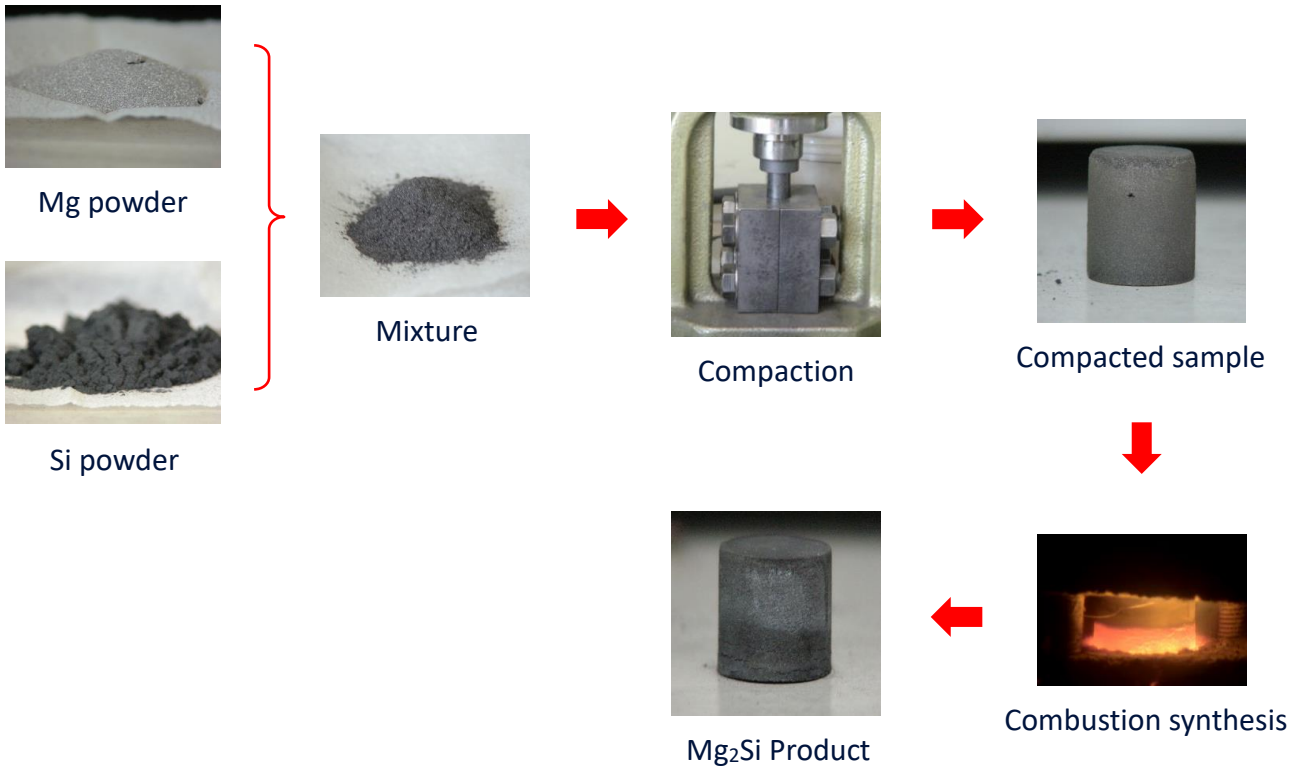

Figure 1 SHS process (Mg_2Si formation)

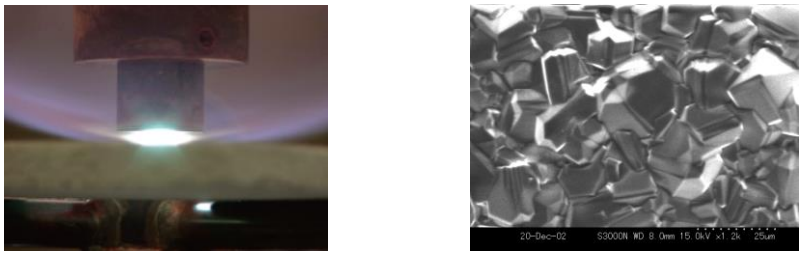

Figure 2 C_2H_2/O_2 flame for diamond deposition and the resulting deposits

Fracture toughness of adherends bonded with adhesives

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Research Keywords	Adhesives, Aluminum alloy, Composites, Fracture		
Technical Fields and Topics possible for collaboration	▪ Adhesion & adhesives ▪ Composite materials ▪ Fracture mechanics ▪ Mechanics of materials		

Details of the Research Theme

To measure fracture toughness of adherends bonded with adhesives for automotive and aircraft industries.

- ***Background***

Adhesives are used to bond similar and dissimilar materials because of their many advantages over conventional bonding methods. Th purpose of this study is to measure the fracture toughness of adhesively bonded joints using double cantilever beam (DCB) tests and end-notched flexure (ENF) tests.

- ***Test methods and Results***

The shape and dimensions of the DCB specimen and the crack extension resistance-crack length curve under Mode I loading are shown in Fig. 1 and Fig. 2, respectively. It was observed that a rising *R*-curve because of brittle behaviors of the adhesive bulk specimens as shown in Fig. 2.

The shape and dimension of the ENF specimen and the energy release rate-crack length curve under Mode II loading are also shown in Fig. 3 and Fig. 4, respectively. The results showed that the energy release rate values increased gradually with increasing crack length.

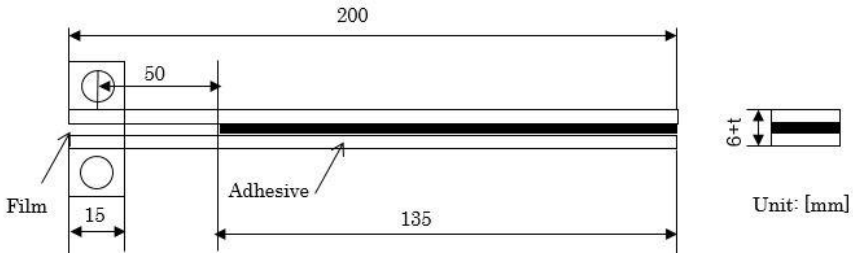

Fig 1. Shape and dimensions of DCB specimen.

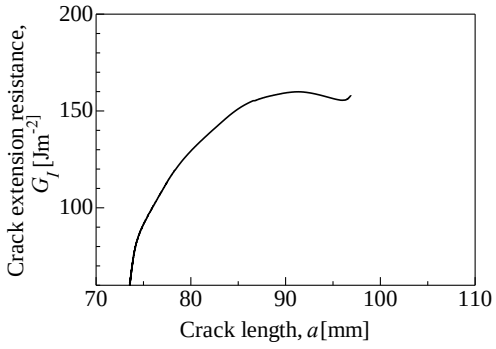

Fig. 2 *R*-curve

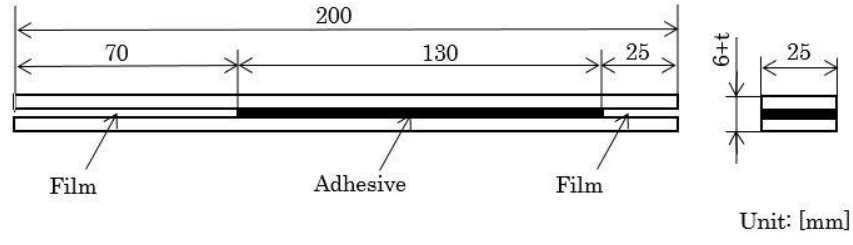

Fig 3. Shape and dimensions of ENF specimen.

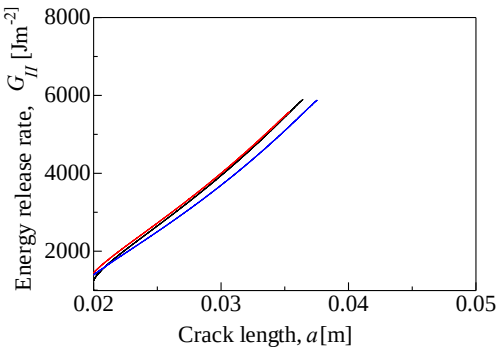

Fig. 4 G_{II} vs crack length

- ***Conclusions***

Fracture toughness of adherends bonded with adhesives were measured using DCB and ENF tests under static loadings.