

# MERIT Corporate Internship Report

1<sup>st</sup> Generation MERIT Student  
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## Host company:

IHI Corporation

## Background:

In PhD course, I am studying on process design and development of chemical vapor infiltration (CVI) to fabricate SiC/SiC ceramic matrix composites (CMCs), where SiC matrix is infiltrated into space within BN-coated SiC fabric. CVI enables film deposition in the same mechanism with chemical vapor deposition (CVD), and filling up the space within the fabric to form CMCs. Thus, CVI process plays an important role on mechanical properties of CMCs. In order to design CVI process with high through-put and conformal filling at the same time, we have to understand the reaction mechanism and the kinetics of CVI reaction, because, for CVI, high through-put and conformal filling are trade-off.

I have revealed the surface reaction kinetics of CVI, and developed the CVI process. Meanwhile, SiC/SiC-CMC will be utilized as aero-engine materials in the near future, and thus their mechanical properties are important. Therefore, through this internship, I aimed to learn the basic of the mechanical properties and conduct mechanical tests on my developed CMCs.

## Activity:

In this internship, I worked on a mini-composite (MC), which is the simplest form of CMCs. MCs were fabricated by conducting BN coating and SiC-CVI onto uni-directional fibers at IHI Corporation. As MCs are fabricated easily at a low cost, they are expected to be utilized to inspect the reproducibility of a series of CMC-fabrication process. The detailed activities are explained below.

### ✓ Structure analysis of MCs

The structures of MCs were quantitatively evaluated, and a relation between the

structure and the mechanical property of an MC was studied. In order to evaluate the structures, the cross-sectional images of MCs were observed using an optical microscope. A cross-sectional shape, number of fibers, and the amount of CVI-deposited SiC matrix were extracted.

✓ Mechanical tests of MCs

Tensile tests of MCs were conducted at room temperature. Based on the fracture mechanism of an MC, effects of the fiber, the interface, and the matrix on the mechanical property were examined. Finally, we revealed a factor, which significantly affects the mechanical property of an MC, and proposed an approach to fabricate MCs so as to reduce dispersion of the mechanical properties.

✓ Others

I learned how to conduct the tensile tests, polishing the MCs, and observing the cross-sectional images of MCs. I learned the basic of mechanical property of composite materials. In addition, I learned a safety management in a factory.

✓ Mechanical tests of my developed CMCs

In a few weeks, I will conduct tensile tests on my developed MCs with different CVI matrix amounts, which will suggest a new aspect helping the design of CVI process.

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