STRENGTHENING OF FIBER-REINFORCED SELF-HEALING CERAMICS

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ABSTRACT

The continuous fiber reinforced self-healing ceramic composites (shFRC) were proposed as one of the candidate materials for turbine blade [1]. The shFRC consists of three components, which are oxide fiber bundle, oxide matrix and self-healing agent interlayer. As the self-healing is generated at only the interlayer, it is necessary that crack propagation is led into the interlayer. However due to large defect size in fiber bundle, the strength of the shFRC is too low (26.8 MPa) to apply turbine blades. To enhance mechanical strength of shFRCs for actual applications, the present study aims to develop the advanced shFRC with small defect fiber bundles.

To decrease the defect size in fiber bundle, the used fiber bundles was applied under tensile stress before the interlayer coating. As a result, the diameter of fiber bundles were shrunk to 2 thirds of the original diameter, as shown in Fig. 1.

Using the small defect fiber bundle allows to employ the high strength interlayer. Thus, 50 wt% $TiSi_2$/ SiC interlayer was used in the advanced shFRC. Furthermore, the $TiSi_2$/SiC interlayer can heal the crack for 10 min at 1000 ^oC. Figure 2 shows the load deflection curves of the advanced and previous shFRCs under three point bending with span of 16 mm. The advanced shFRC has 178 MPa strength, corresponding to the 7 times higher strength than the previous shFRC. Since the materials for turbine blade are required to have more than 140 MPa, the advanced shFRC has enough high strength to apply for turbine blade.

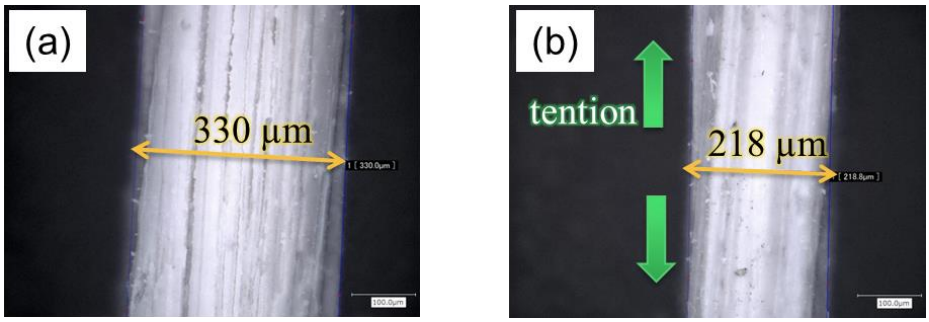

Figure 1: (a) Photograph of previous fiber bundle.
(b) Photograph of previous fiber bundle under tensile stress.

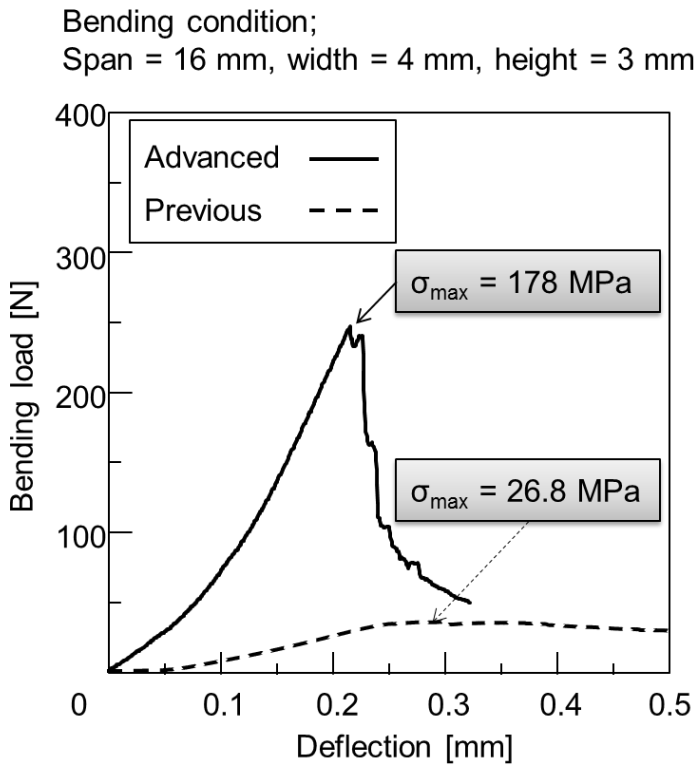

Figure 2: Relationship between deflection and bending load.

REFERENCES

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