Mechanical properties of carbon microcoils (CMCs)

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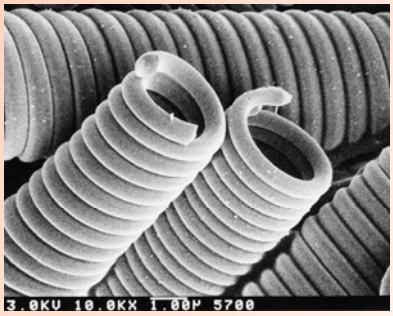
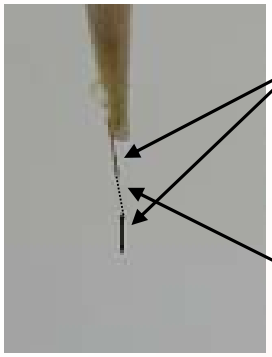
CMCs (carbon micro coils) are a kind of carbon materials that characteristically have a strong mechanical intensityand elasticity. CMC/polymers composite technology is in CMC tactile sensors and CMC EM wave absorption materials. It is considered that the characteristic of CMC tactile sensing ability and EM wave absorption ability strongly depends on the spring constant. Therefore, it is important to measure the spring constant of CMCs and developing techniques to manufacture CMCs with large spring constant.

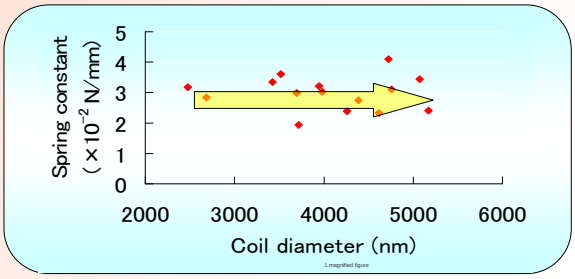


SEM images of the CMC

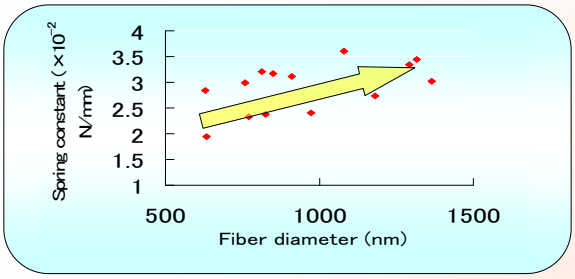
magnified figure



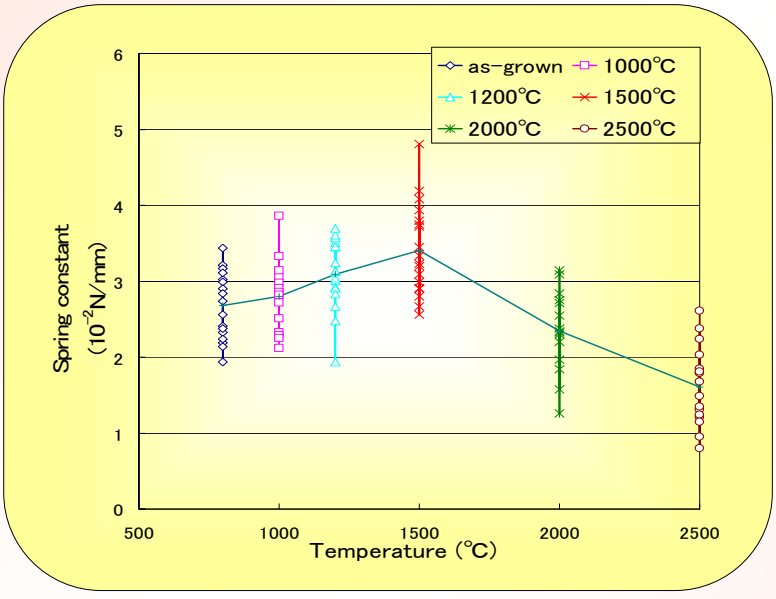
Picture of laboratory equipment



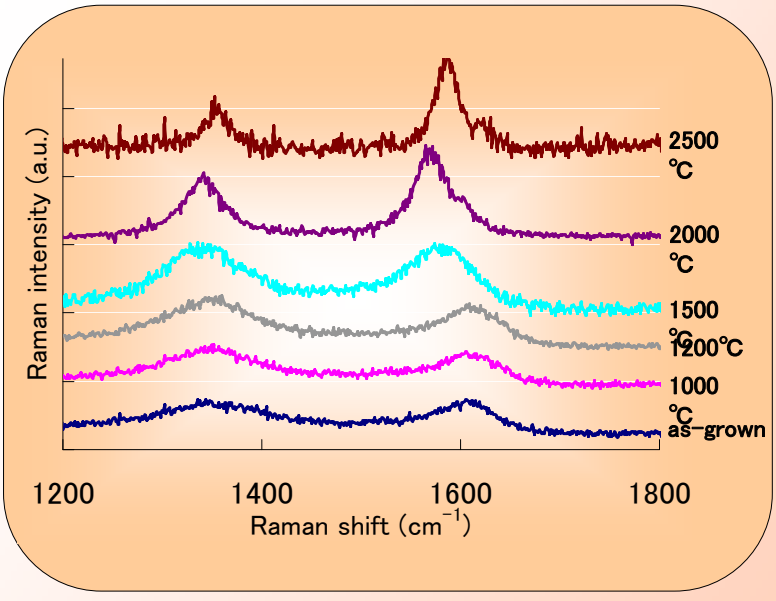
Relation between spring constant and coil diameter



Relation between spring constant and fiber diameter



The spring constant vs various thermal treatment temperatures



Raman spectra of CMCs treated at different temperature

Conclusion

- Spring constant doesn't have correlation to the coil diameter, but it increase with increasing the fiber diameter.
- The spring constant increased up to highest value 3.41×10^{-2}N/mm at 1500℃, but it decreases with continuously increasing temperature. The lowest spring constant is 1.61×10^{-2}N/mm at 2500℃.
- After treated at 1500℃, their structure is dramatically changed, comparing to the CMCs treated below 1200℃, and this structure is benefit to the high CMC spring constant.
- After treated at more than 2000℃, D-band get much smaller than G-band. It shows that the structure of CMC change amorphous structures into graphite structures.