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Carbon Fiber Material in Musical Instrument Making

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Abstract: Scientists have been trying to make musical instruments with novel materials in recent years. In this research, we set up a system to test carbon fiber musical instruments. A carbon fiber cello was successfully prepared and its sound quality was measured by Chladni experiment and Fourier analysis. The criterion of musical sound by Fourier analysis is defined and demonstrated. According to this research, carbon fiber was indeed a good novel material in musical instruments making with the significance of technological process, environmental sustainability and art.

Key Words: carbon fiber, novel musical instrument, cello, environmental protection.

1. Introduction

It is well acknowledged that a high quality musical instrument must be as light and thin as possible while having essential mechanical properties. Carbon fibers have been widely used in light of their excellent properties including lightweight, high strength and modulus [1]~[2]. It weighs less than 1/4 of steel and its extension strength is over 3,500MPa, which is 7 to 9 times of steel. Its tensile modulus of elasticity is 230 to 490GPa, also higher than steel [3]. Therefore, carbon fiber is an outstanding material to be considered to build a musical instrument. In November 1994, a carbon fiber guitar was displayed on the biggest public musical instruments exhibition in Britain. The utilization of carbon fiber decreased the weight of musical instrument, enhanced its mechanical strength, and enabled it to produce resonance [4].

To explore the utilization of carbon fiber in musical instrument making, its mechanical strength should be measured and compared with wood fiber [5]. The acoustic vibration performance of carbon fiber was tested and the acoustic of carbon fiber cello was revealed by Fourier analysis [6].

2. Materials and Methods

2.1 Preparation of the carbon fiber cello

A model cello was made in Shanghai Haiyi Plastic Factory. First, a traditional wood cello was disposed of for later demoulding and made into a model. Then glass fiber was adopted to make a mold based on the model. The mold was coated with a bed of mold release, and then the calculated number of carbon fiber with epoxy resin was