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Design and Manufacture of Self Balancing Liquid Surface Tension Coefficient Measuring Instrument

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ABSTRACT

Experimental Study on Determination of liquid surface tension coefficient of the laboratory based on ring Leveling Problem and influence on surface fluctuation of the lifting platform and different temperature measurement issues related to measure the liquid surface tension coefficient are studied; the design and development of new measuring instrument and equipment at present. In measuring the liquid surface tension coefficient can be controlled at about 4% and the error is smaller, the traditional instrument measuring coefficient is generally around 8%, the measured data accuracy is greatly improved; the design of the instrument temperature controlled at 1 degrees, while the experimental instruments are not currently capable of temperature regulation, expand the the width of the.

Keywords : self balancing temperature control and measuring device

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INTRODUCTION

This topic is involved in the design of the fourteenth "Challenge Cup" competition of Sichuan province undergraduate extracurricular academic science and technology works. According to the laboratory for experimental determination of pull-out method of liquid surface tension coefficient, the widespread use of eye judgment whether rings regulation level, rough adjustment, manual rotation of the ring and out of the water by hand, resulting in difficult to adjust to the measured ring level, measured from the liquid level of stationary ring cannot measure the liquid surface tension coefficient in in laboratory, experimental data there is a big error. At present, the laboratory instrument can not measure the liquid surface tension coefficient at different temperatures. In order to adjust the level of the rings, rings can balance out of the water, and can measure the liquid surface tension coefficient at different temperature; the special design of the self balancing device and temperature control device, self balancing device (the ring automatic temperature control and maintain level) and measuring device (can be measured under different temperature and liquid surface tension coefficient).

MATERIALS AND METHOD

Design background

Liquid surface tension coefficient measurement

At present, the domestic physical experiment course - liquid surface tension coefficient test (adruption) is not application specific.

Lifting balance device. Pull off the liquid surface tension test, is made up of three line rings, but the ring balance degree of difference, resulting in large experimental error. [4]

There are two kinds of measurement methods, one is the coke scale, the other is the use of silicon pressure sensor. Silicon pressure sensor sensitivity than the traditional Joly balance, torsion balance high, good stability, and can realize the digital signal to computer display, real-time measurement.[3]

As the liquid surface tension coefficient and the temperature of the liquid to be measured, the higher the temperature of the liquid, the smaller the value of the liquid surface tension coefficient[1]. Based on the measurement of surface tension coefficient of liquid silicon pressure[2] sensor measuring instrument to measure the liquid surface tension coefficient most only in certain environmental temperature, measurement of liquid cannot change with temperature, the change of surface tension coefficient, it has some limitations. But in the actual operation of the process, because the ring is not easy to adjust the level, the vibration of the platform to make the surface of the water is not smooth and the instrument is not accurate and other problems, resulting in a large measurement error.

To achieve the balance of the lifting ring and more accurate measurement of different temperature liquid surface tension coefficient

Based on the above problems, the project team wants to explore the design of a device can easily adjust the balance of the rings, the rings can easily be at the level and not by a thin wire connection, with a certain degree of stability. In this way, the rings can be more balanced and stable. The device can be used to measure the liquid surface tension coefficient more quickly and accurately with the appropriate temperature control device.

Design plan

The whole equipment is divided into two parts: the design of the main innovation lies in the adjustment of the level of self balancing device; the other part is the combination of temperature control and measuring device.

Design of self balancing device

Connect three parallel plates by three vertical steel rods, the middle plate can move up and down, so that the center of the circular groove plate and circular plate in the same plumb position; then using the principle of circular concentric rings on the circular groove at the center of the rings can easily find a plumb position, and through the thread connection, and at the right the position of the filament glue stick together; the rings is easy to hit level. The following illustration:

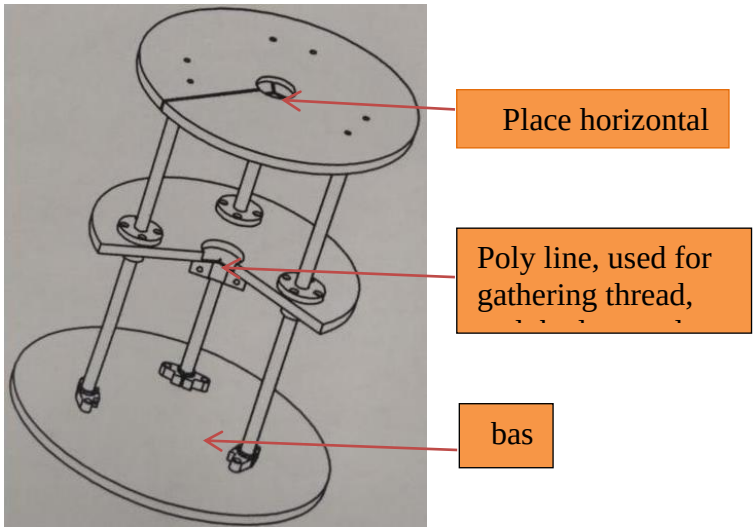

Fig.3.1a three-dimensional diagram of the self balancing device

Board

The diameter of 250.000mm thick 10.000mm disk, the inside has a diameter of 35.002mm thick 5.000mm and the same center of the groove, used for clamping ring. Groove along the radius of 3 into a 120 degree angle width of 2.000mm seam. One of the cracks along the large disk radius, directly to the edge of the disc. The following illustration:

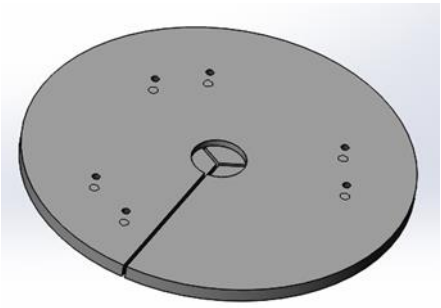

Fig.3.1.1a on the board three-dimensional

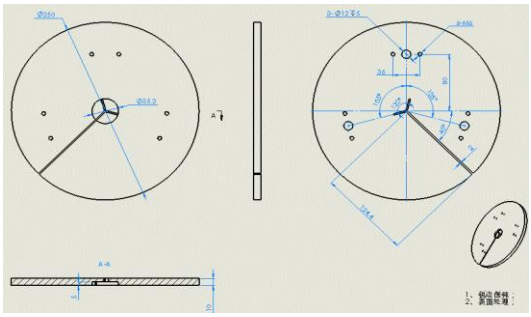

Fig.3.1.1b engineering drawings

Medium plate

The diameter of the 250.000mm thick 10.000mm disc, the internal diameter of 40.000mm thick 2.000mm of the center of the groove, the groove is located at the center of the 1.200mm through hole. Through the hole to connect a long 20.000mm wide 0.600mm rectangular, rectangular outside a 120 degree opening. Shown below:

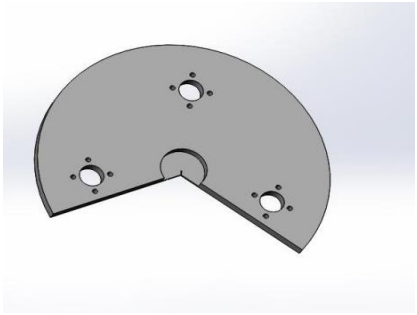

Fig.3.1.2a in the plate three-dimensional

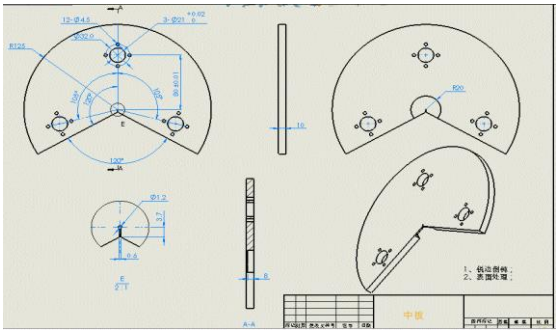

Fig.3.1.2b plate engineering drawings

Lower plate

Lower plate structure is relatively simple, a diameter of 30.000mm thick 10.000mm aluminum circular plate, in addition to the fixed hole, no other redundant structure.

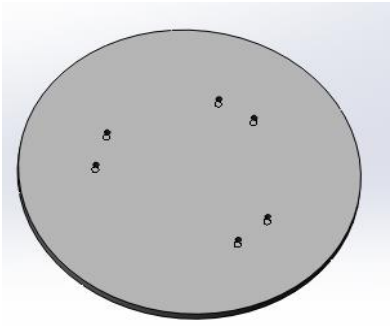

Fig.3.1.3a under the three dimensional plate

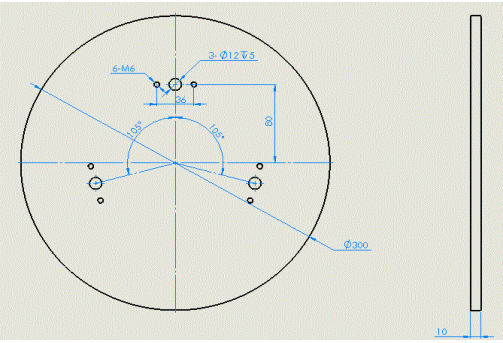

Fig.3.1.3b engineering drawings

Temperature control and measuring device

We integrate the temperature controller with the experimental measuring instrument to become a temperature control and measurement device. The instrument can realize the measurement of the liquid surface tension coefficient under different temperatures, expand the scope of application of the experiment, the measurement personnel to the aspects of the experiment, but also with controllable temperature makes the data more accurate and effective measurement.

The tension coefficient measuring instrument mainly includes sensor probe, signal conditioning module, analog-to-digital conversion module, data storage module, data processing module, display module, key input part, temperature acquisition module, temperature control module, heating refrigeration, communication interface, power

source modules. Join the temperature sensor in the device for real-time monitoring of temperature, coupled with the use of cooling fan and heating semiconductor, you can easily change the temperature of the liquid to measure the liquid surface tension coefficient under different temperature, the strain sensor, the temperature sensor, the panel will set the related pressure and temperature data feedback to MCU data processor for processing, through the preparation of the corresponding procedures can be directly recorded by the ring out of the maximum pressure in the process of water and the related data are displayed on the display screen[2]. At the same time, the use of micro spiral device instead of the traditional decline can make the ring more stable and liquid separation.

CONCLUSION

In this paper, the self balancing liquid surface tension measuring instrument is designed to improve the laboratory teaching instrument, which can be used to measure the liquid surface tension coefficient at different temperatures, and to ensure the high accuracy.

The self balance adjusting device of the lifting ring can easily realize the balance adjustment of the lifting rings, and the utility model can effectively avoid the large error in the experiment when the lifting rings can not be adjusted in or near the horizontal state. In addition, the device can also test the liquid surface tension at different temperatures, can expand the width of the teaching experiment.

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