

LOW COST ACCURATE SOLAR SIMULATOR FOR SOLAR CELL TESTING

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ABSTRACT

Solar simulators are key test systems used in the development and manufacturing of photovoltaic, cosmetics, paints and coatings, protective sports clothing and many other materials and devices. Sun simulators in photovoltaic devices testing according to the standard International Electro technical Commission (IEC) 61215. The accuracy of tested photovoltaic devices depends on accuracy of sun simulator they tested such as correct solar spectrum, intensity. Such a solar simulators cost is high and not easy to handle and maintains. The proposed system find solution for reduce cost in light source instead of high cost lights and increase accuracy using filters and make it size in small to easy to moveable.

Keywords: Solar simulator, Accurate, Low cost

1. INTRODUCTION

With increase of human population and growing technology, requirement for energy goes high which leads to find new clean sources of energy. According to the World Energy Council 2013 survey (23 rd edition of the survey) ,where 2011 (WEC 2013) reports show that, from 1993 to 2011 population has grown from 5.5 billion in 1993 to 7 billion in 2011 which is a 27% growth. And simultaneously energy resources requirement has gone high. Considering separately from year 1993 to 2011, coal requirement has gone up 68%, oil by 25%, natural gas by 62%, and nuclear by 13% and hydro power by 21%. And electricity production per year has risen by 76%. Same time CO₂ emission has gone high by 44% when comparing year 2011 with year 1993. With increase of population it is essential to find efficient and effective methods to

harvest energy from clean renewable energy sources, such as sun and wind^{1,2,3}. For give solutions for energy requirement most researches focused on solar power. Therefore the solar cell innovations has a daily improvement. The testing purpose of the solar cells should be want to simulated sun light. Therefore the proposed simulator directly focused more accurate solar simulator.

2. METHODOLOGY

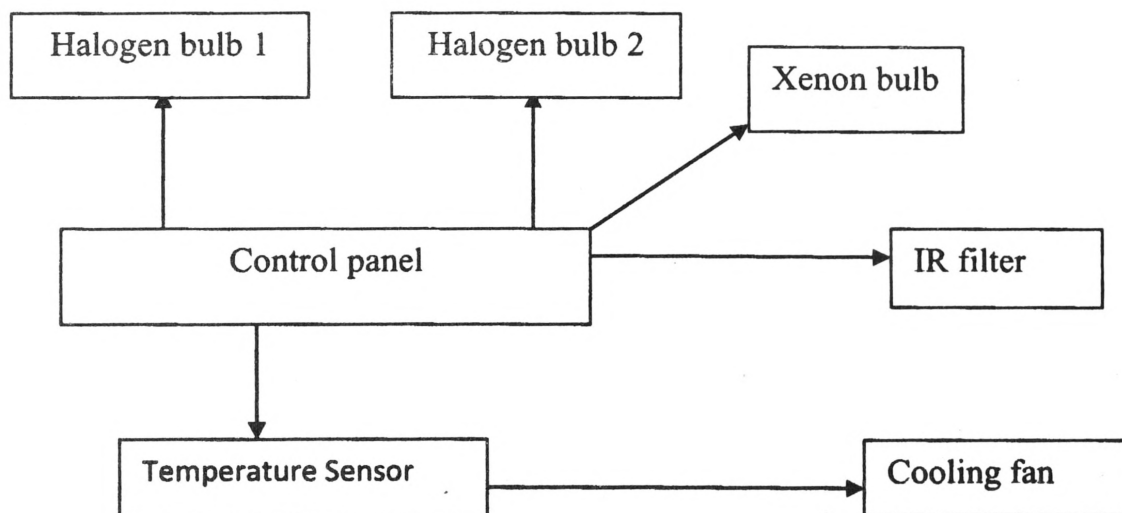


Figure 1: Block diagram of solar simulator.

The solar simulator consists on two parts. Power supply unit and IR filter cooling unit include in fixed part. Light source and filters include in moving part⁴. The power supply transformer 24v and10A step-down. Light source is 250W Tungsten filament halogen bulb.

The simulator includes 3 filters⁵.

- IR filter

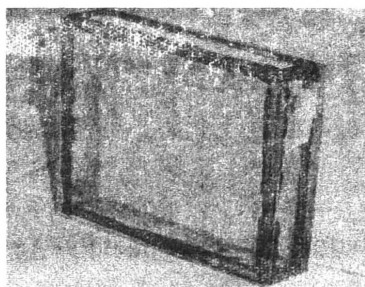


Figure 2: IR filter

AM 1.5G Filter

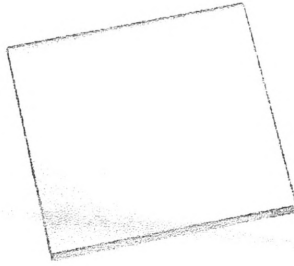


Figure 3: AM 1.5G filter

Colour Filter

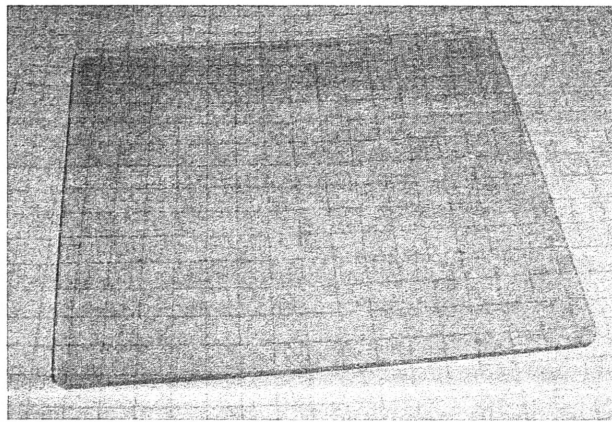


Figure 4: Colour Filter

Figure 5 shows internal assemble of moving part with cooling fan, reflector and IR filter.

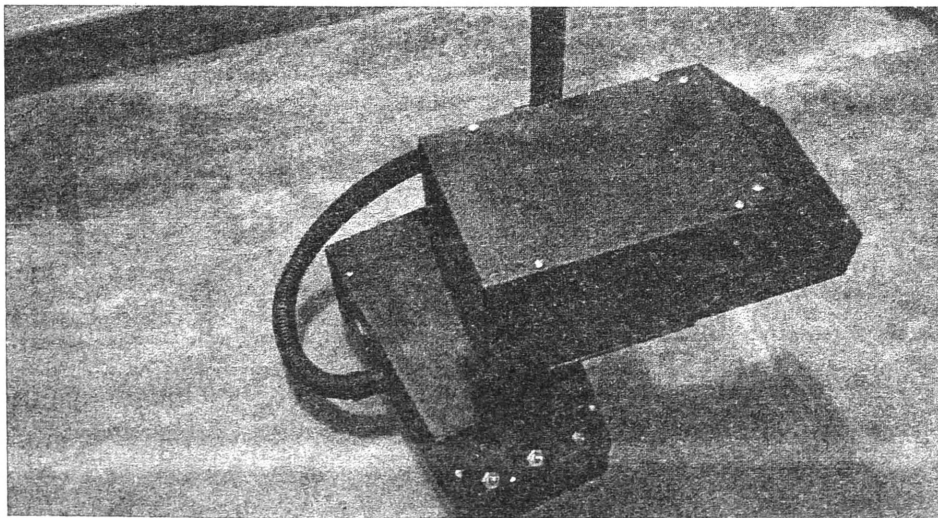


Figure 5: Implemented system for solar simulator

3. RESULT AND DISCUSSION

The instrument tested with the commercial available solar cells. Generated voltages same as the solar cells with normal sunlight.

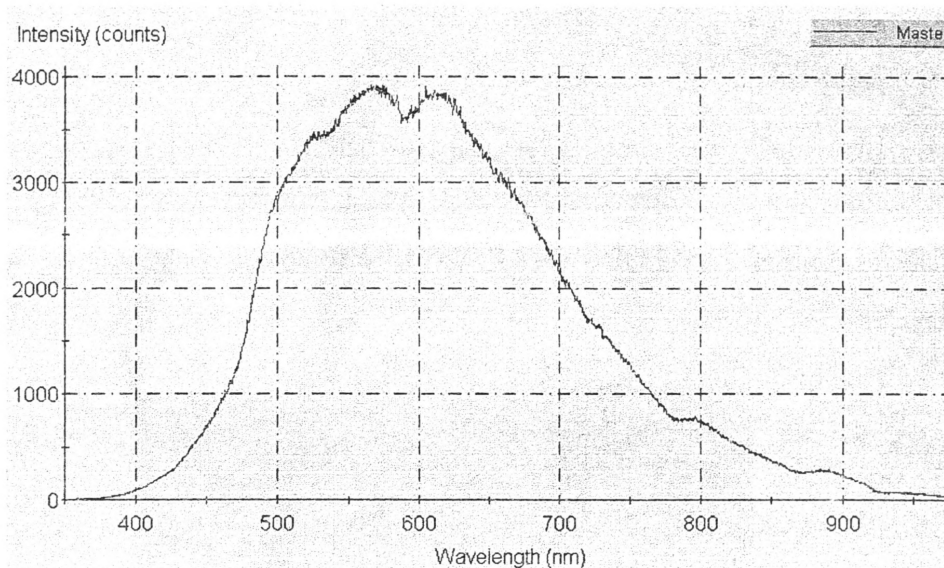


Figure 6: halogen light intensity spectrum

Proposed solar simulator is low cost and accuracy is high. The instrument use three filters for improve the output light Quality.

The instrument is not use collimating lenses. Therefore collimating lenses decreases the intensity. For test the spectrum and simulate the light source and reflector use Trace pro software.

The accuracy of the solar simulator can increase accuracy using Xenon arc lamp. Because of the colour temperature of the sun is approximately 5800K. But halogen light colour temperature in between 3000-3800K. Xenon light has colour temperature between 5000-6500⁶.

4. CONCLUSION

The solar simulator is a device that can approximately simulate the sun irradiation. For standard PV testing solar simulators, lots of research work has been done for improving the spectrum accuracy and reducing the cost, which will continue with the emergence of novel light sources and optical designs. Furthermore, portable, low power consumption and long life time are the other trends in the future simulator design⁷.

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