

# Experimental Research of AC Ripple Losses in A HTS Current Lead of A Magnet

Hongwei Liu, Guosheng Song, Chuanhui Zhang, Jinwen Tan

Key Laboratory of HV and EMC Beijing, North China Electric Power University, Beijing 102206, China



North China Electric Power University

## Background

In the circumstances for the bulk transmission of current lead in a magnet, HTS DC cables used as current leads for the magnets has great advantages. However, the AC loss is one of the important parameters of HTS DC cable and it has strong effect on its stability and operation cost. In this paper, we measured AC ripple losses of HTS tapes and the power cable. Moreover, the conclusion of the relation between AC losses and the power frequency was made.

## Objectives

- ❖ DC currents with AC currents of different amplitude and frequency
- ❖ The AC ripple losses was measured.

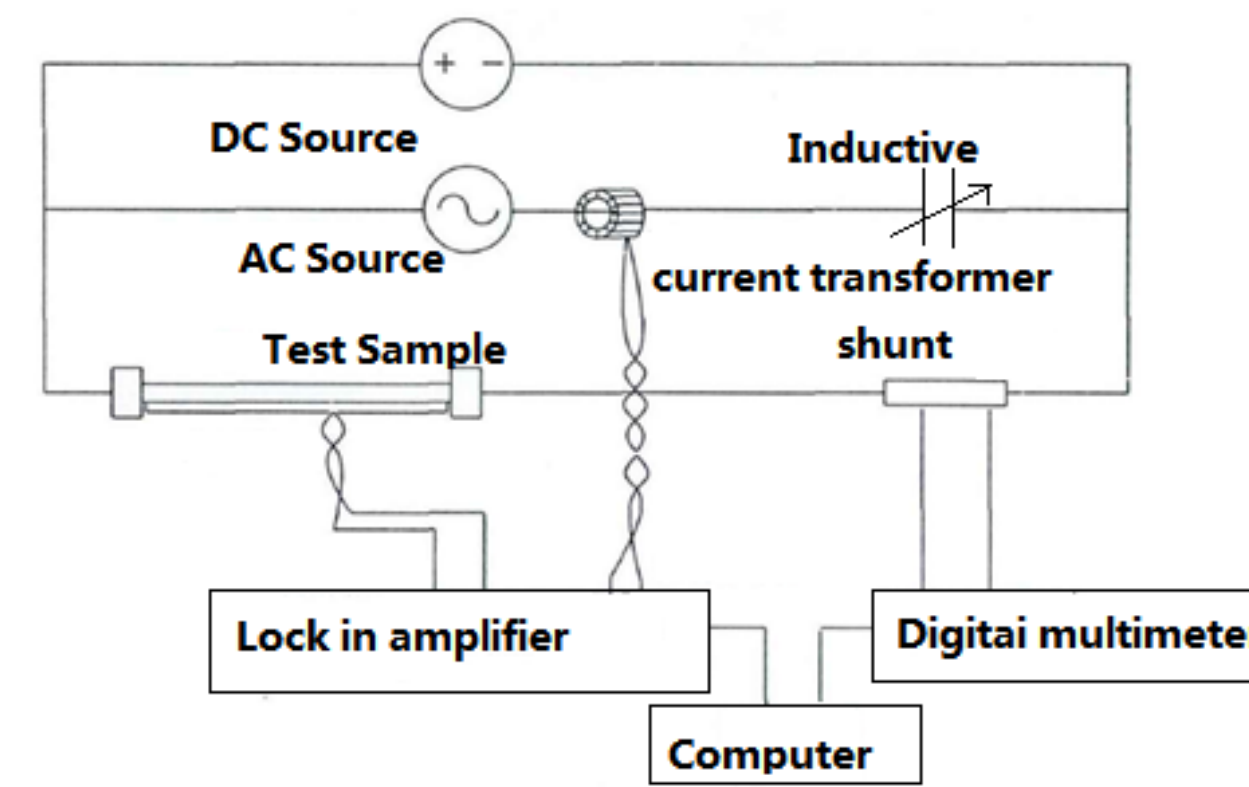
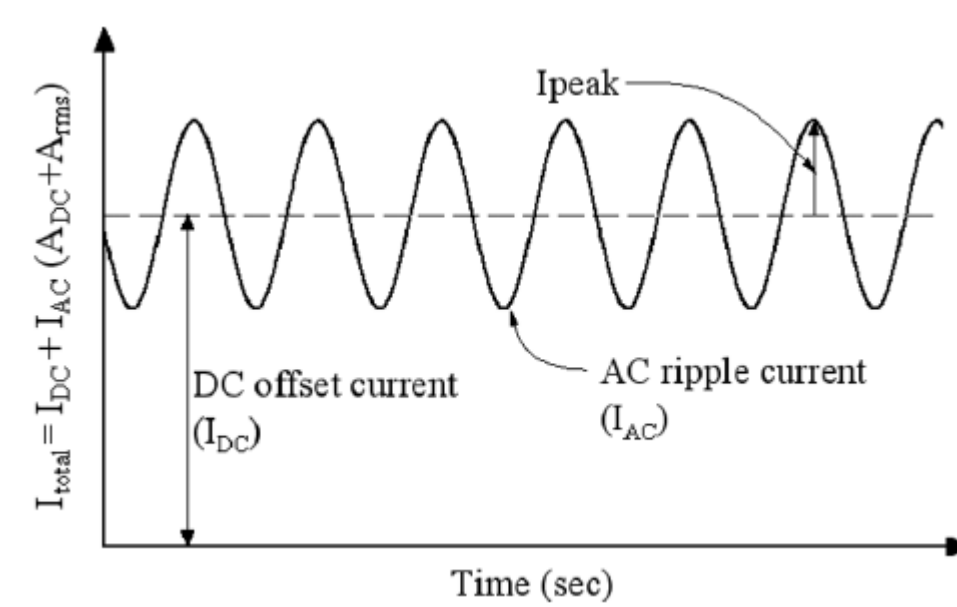
## Conclusion

- ❖ AC losses increased with the amplitude of AC currents at the fixed DC current.
- ❖ The frequency of AC current did not have much more influence to the AC losses.(The frequency range is from 50 to 350Hz.)
- ❖ When the DC current and the magnitude of the AC ripple current approach to the critical current, AC losses increased remarkably.

## Methods

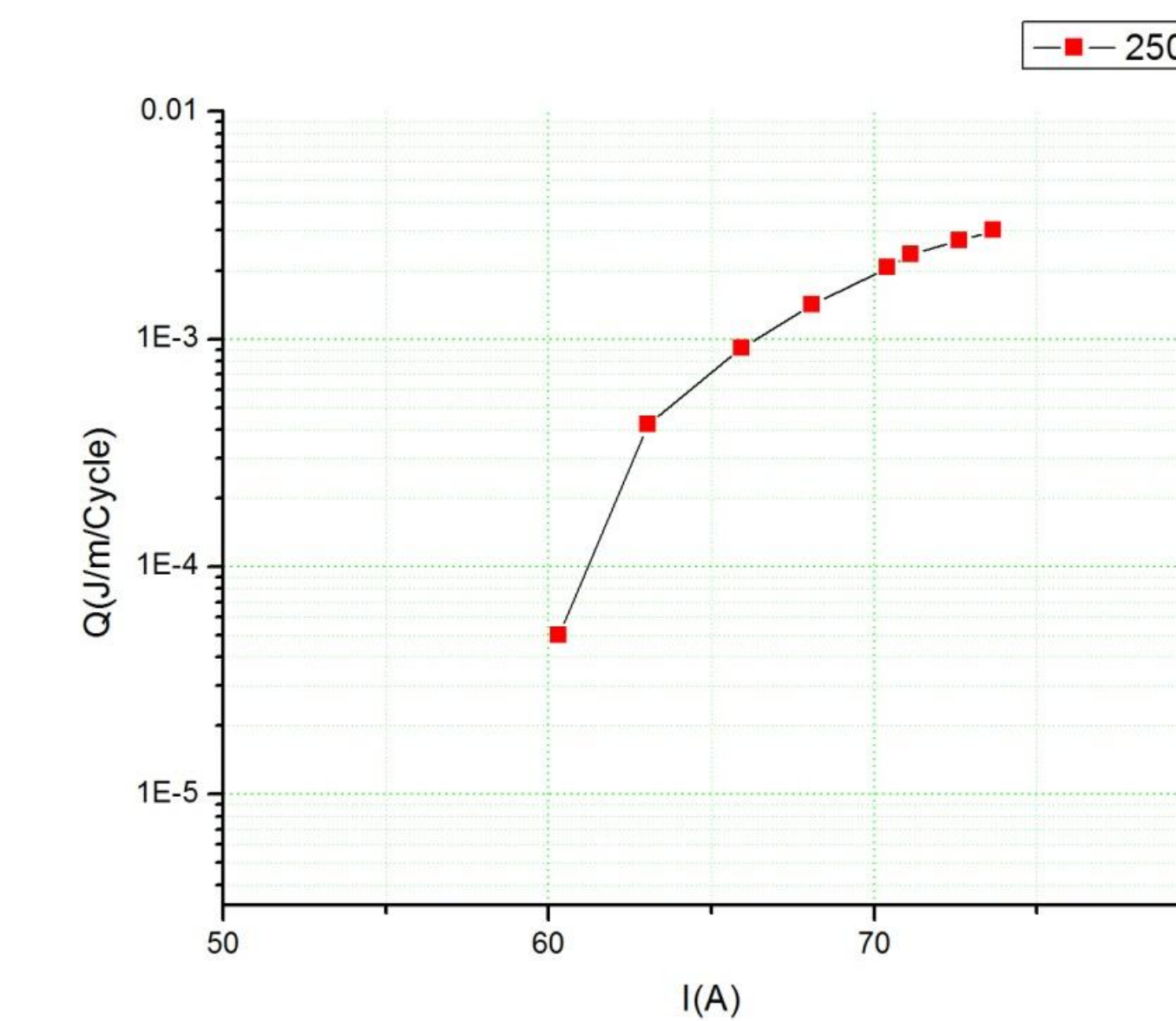
### Experimental Setup

An experiment was set-up at North China Electric Power University, using the parallel connection of a DC source and an AC source whose magnitude and frequency could be adjusted.



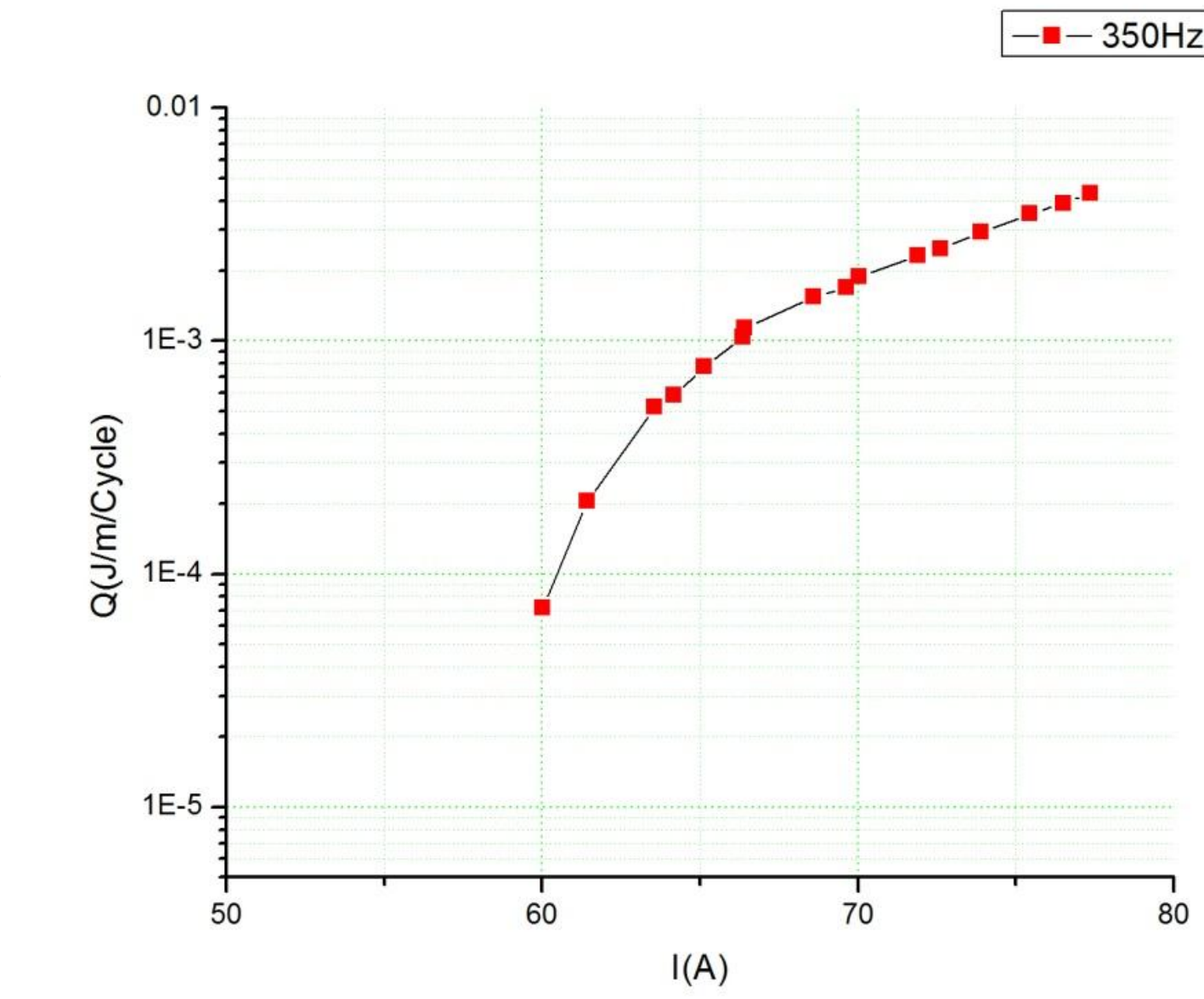
An adjustable capacitance was used in case that the DC current circulated to the branch of the AC current.

### Experimental Procedures



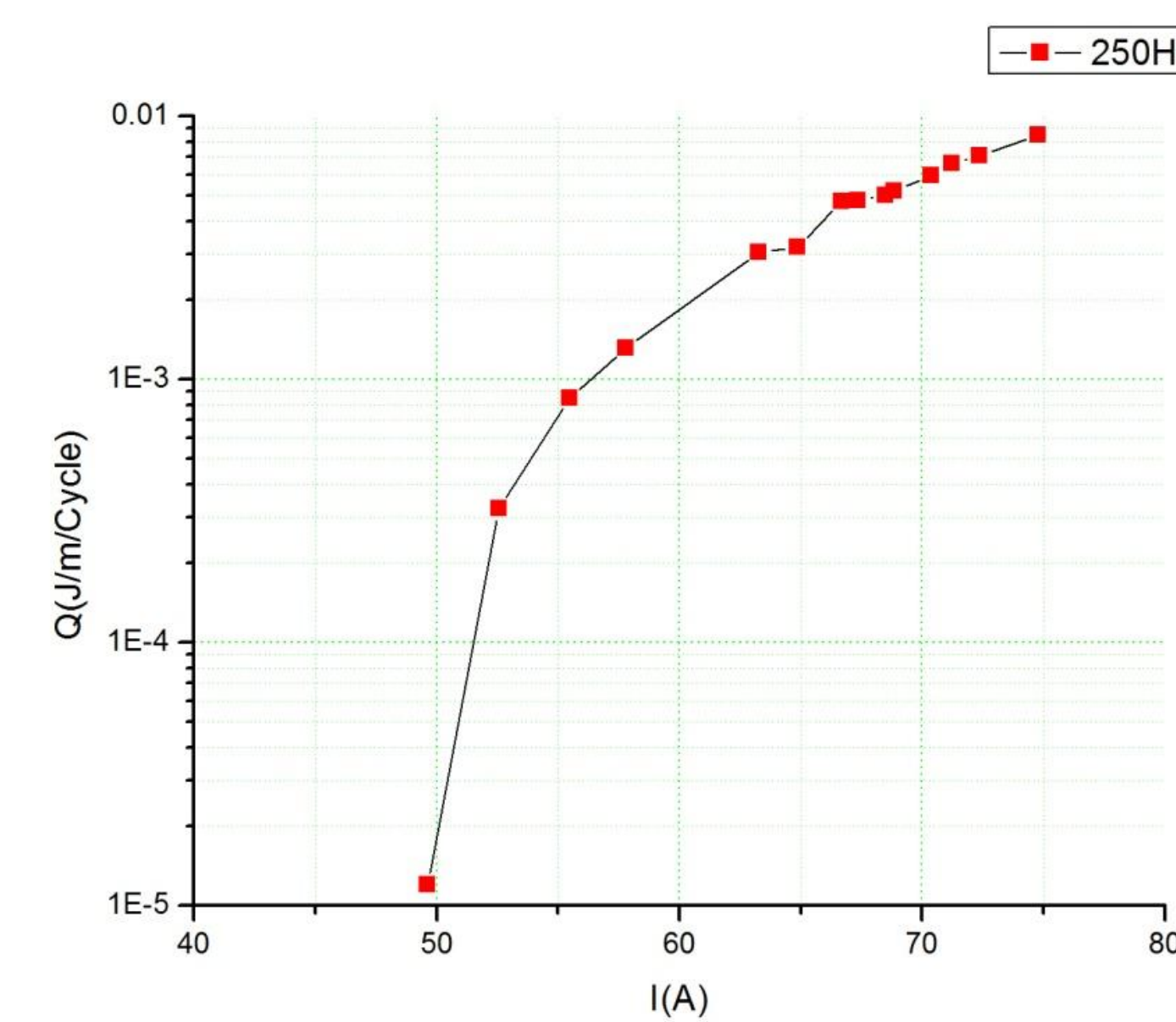
$I_{DC}=55A$

At the DC current of 55A, we increased the amplitude of the AC current from 5A to 20A, Thus the total current was from 60-75A.

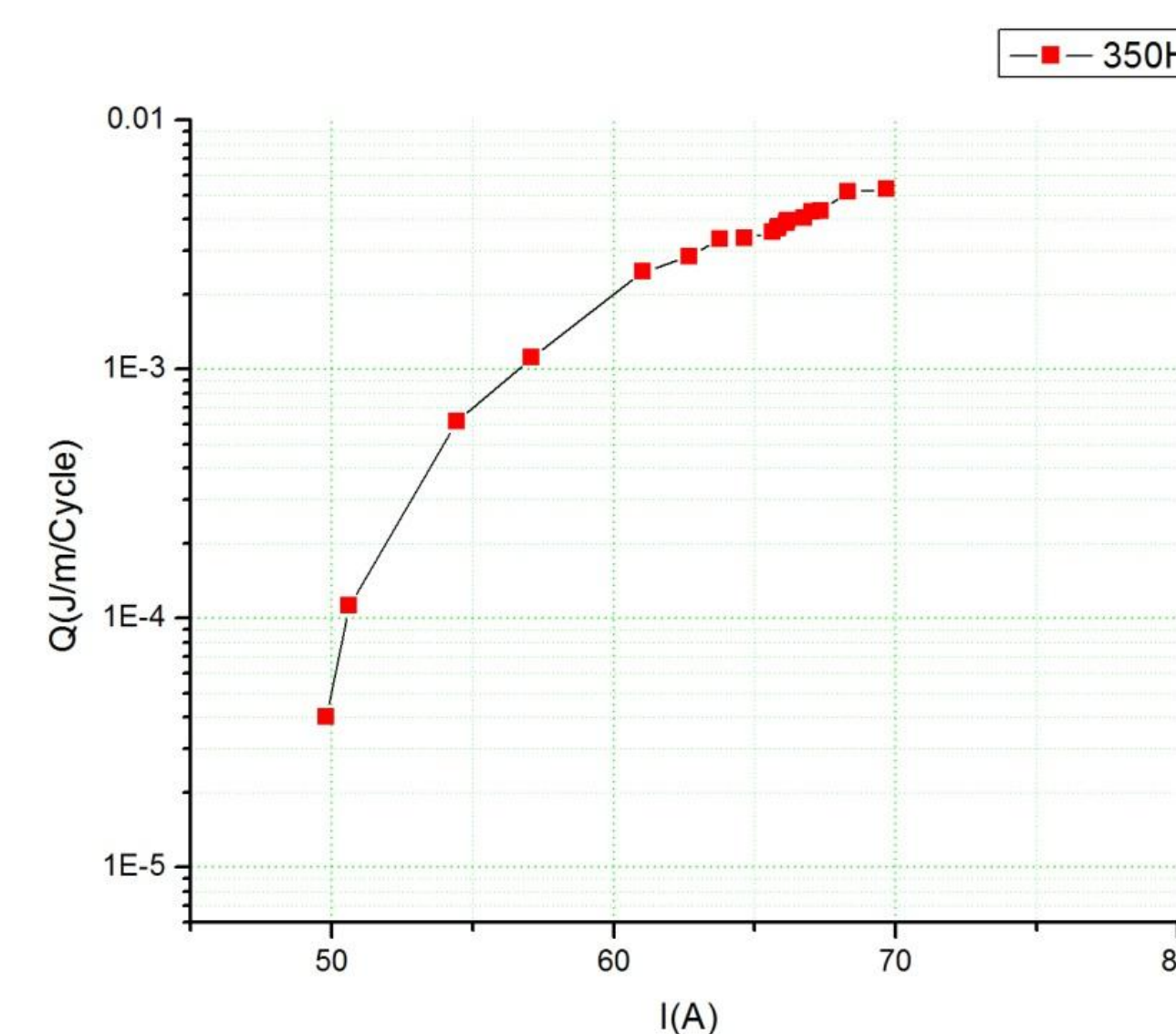


## Results

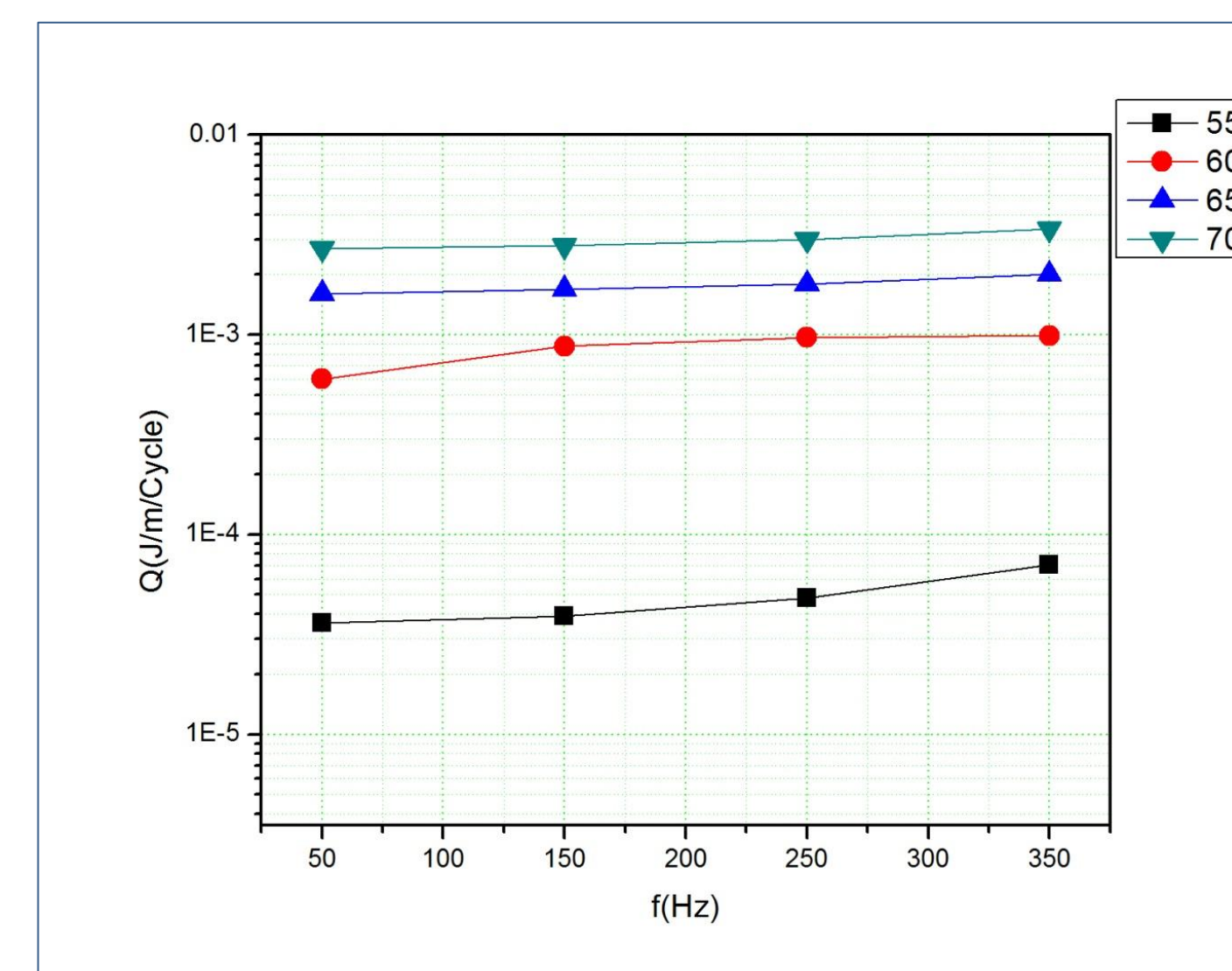
### Mechanical and Resistivity Characteristics



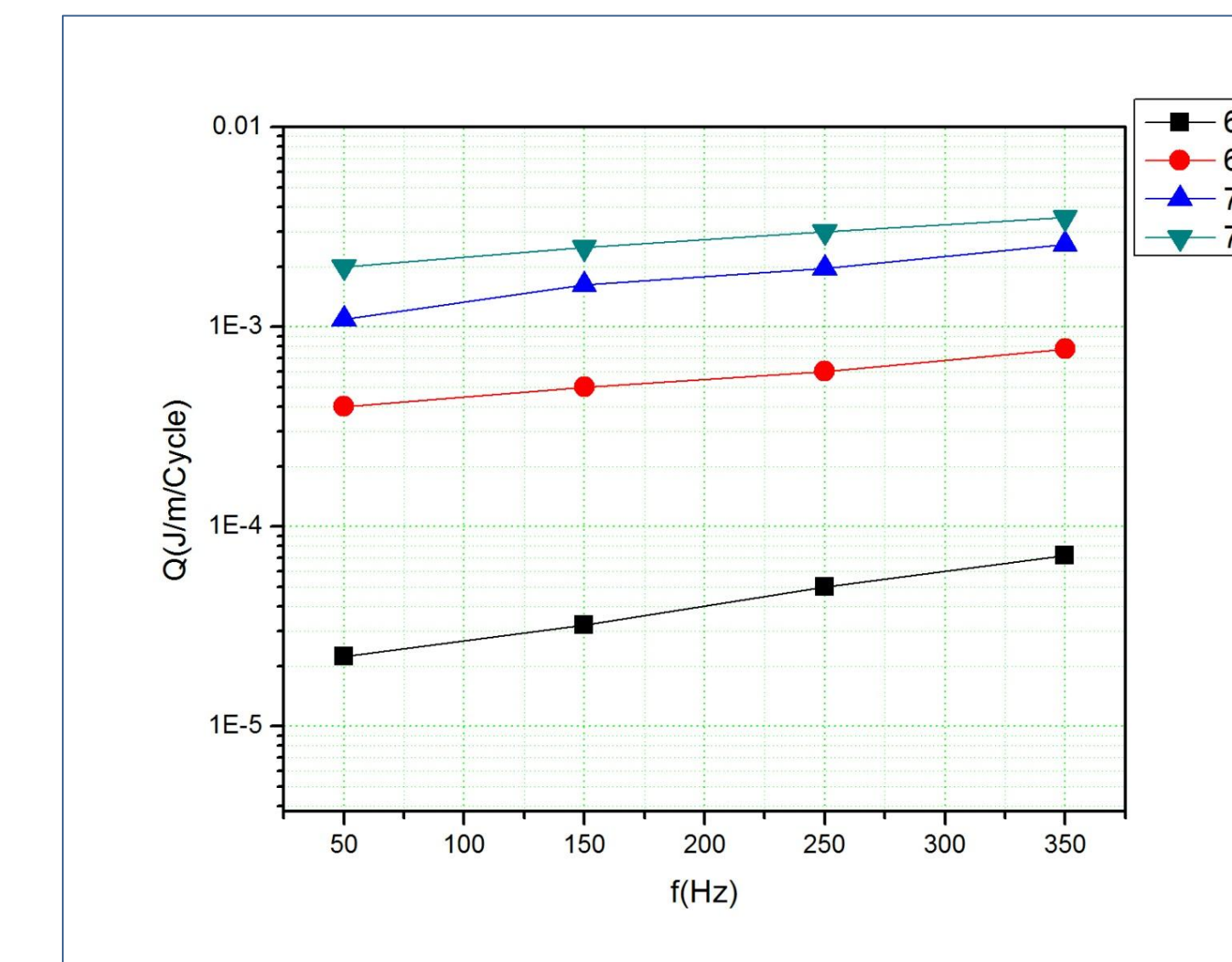
$I_C=60A$   
2.5mm\*0.18mm



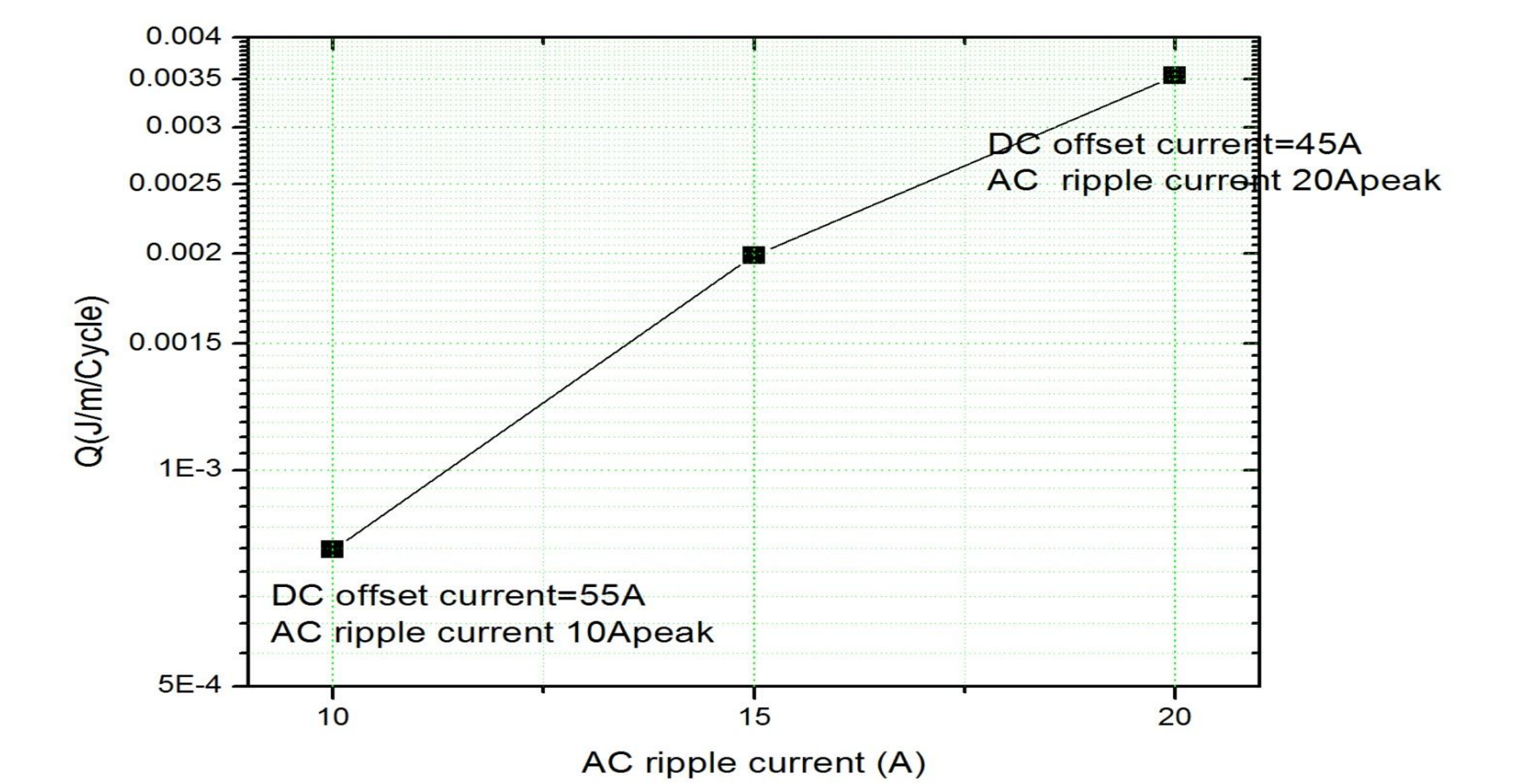
$I_{DC}=45A$



AC losses at  $I_{DC}=45A$ , and AC current at frequency of 50Hz, 150Hz, 250Hz, 350Hz



AC losses at  $I_{DC}=55A$ , and AC current at frequency of 50Hz, 150Hz, 250Hz, 350Hz



AC losses at the same total current but different DC and AC current component.