Review Various Trends in Piezoresistivity

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Abstract
In this study the piezoresistivity behavior of the smart cementitious material studies have been reviewed. The ratio of piezoresistivity to stress at that point has been compared for the various studies done by researchers. The variation in the trends has been discussed. Under compression loading, change in piezoresistivity varied from 45 %/MPa to -2.1 %/MPa. Under tensile loading it varied from 3.7 %/MPa to 1.2 %/MPa.

1. Introduction

Smart structures have been gaining a lot of importance to counter the problems existing in the world today. These methods of measuring the piezoresistivity have the potential to improve the efficiency in monitoring cementing systems. The sensing provides an electrical, optical or acoustical response to any elastic or inelastic deformation in real time during dynamic loading. Several studies have been carried on the ultrasonic cement analyzer as the only continuous characterization method for concrete; however, this method has constraints in its application to the field studies.

2. Objective

To study the various methods used by several researchers, to check piezoresistivity and establish a comparative trend for the results obtained by them.

3. Discussion

There have been different methods for measuring the electrical resistance and then calculating the change in resistivity for the applied loading (tensile and compressive). Pu-Woei Chen et al. (1995) used the concept of smart structures for concrete, using electrically conducting short fibers in concrete. They used DC method to measure the electrical resistance. HAN Baoguo et al. (2012) have used the electrical resistivity measurements obtained from a DC source to observe the piezoresistive nature under repeated compressive loading. Vipulanandan et al. (2015) suggested electrical resistivity measurements using an AC source as a simple, economical and nondestructive method for monitoring the long-term characterization of oil well smart cement. They also studied the piezoresistive behavior of smart concrete which is defined as the changes in the electrical resistivity of the materials with applied loading. As we can see in the figure.1, under compression loading, Vipulanandan et al. suggested sensitivity of 45, while Chung et al. suggested 1.9 and Han et al. suggested -2.1. as illustrated in figure.2, under tensile loading Vipulanandan et al. suggested sensitivity of 3.7, while Chung et al. suggested 1.7 and Suryanto et al.suggested 1.2.

4. Acknowledgement

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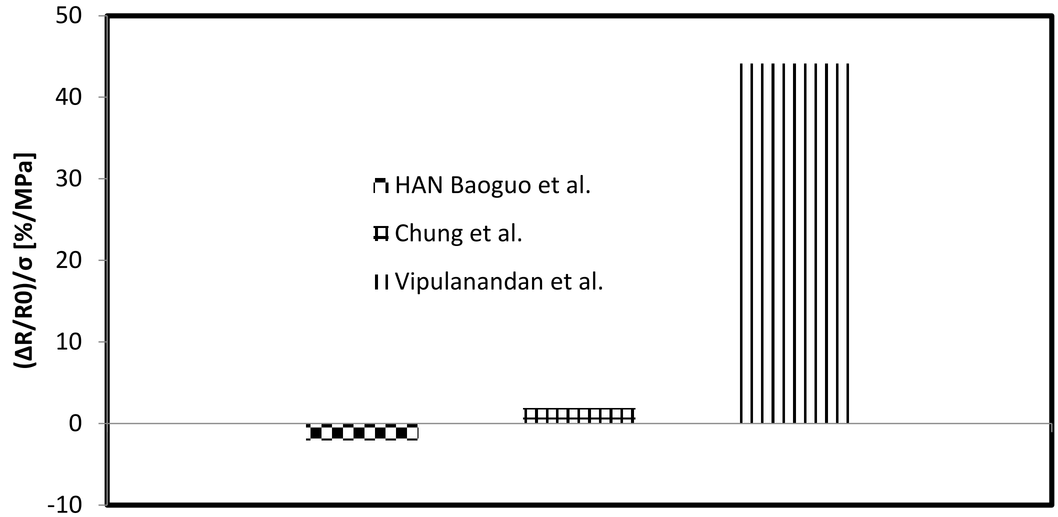

Figure 1: Piezoresistive behavior of the cementitious material under compression loading

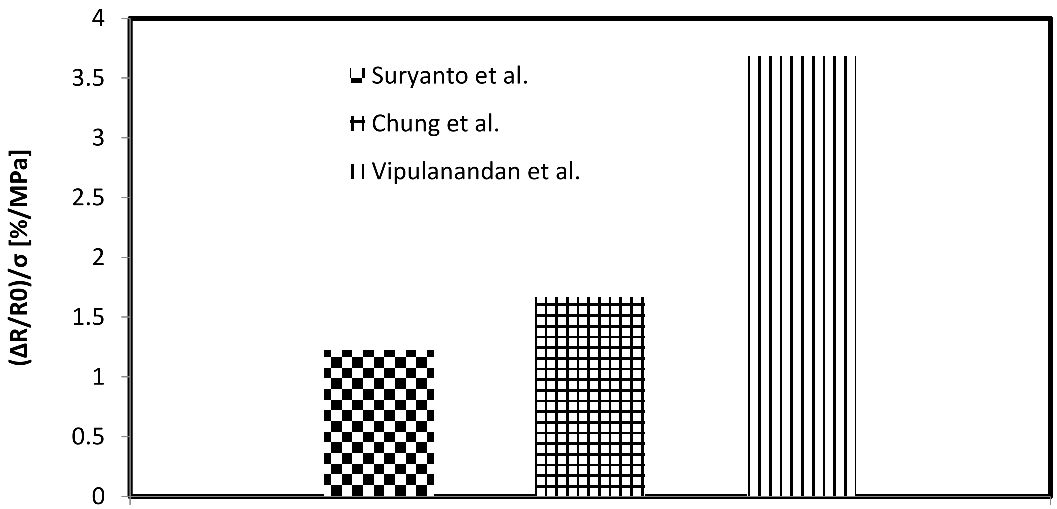

Figure 2: Piezoresistive behavior of the cementitious material under tensile loading

5. References

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