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## Estimation of depth of concrete column members using impact echo method

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Reinforced concrete structures get building aging and functional deterioration phenomena due to various complex factors as time passes. In order to maintain the existing concrete structures in a safe and usable state, an overall maintenance management is necessary regarding structure aging from quality management of new construction. Thus, non-destructive testing is needed to estimate the structure damage, defect, or proper construction without damaging the structure. In U.S., there is a standard for non-destructive test (ACI 228.2R-98), and also in Japan, the non-destructive test method and compressive strength estimation manual was prepared by the Architectural Institute of Japan in 1983, and there are active researches in the ground field, but it lacks verification in architecture field. Thus, in this study, a technique that can estimate the depth of concrete column member using the Impact Echo method which is one of the non-destructive test methods shall be reviewed and evaluated for applicability to the architecture field. The equipment used in testing is Freedom Date Pc Platform WinTFS 2.5.2 by company Olson of U.S., and the experiment involved leveling the top surface of the concrete member, installing the equipment and applying impact 9 times, and taking the average of the reverberation values obtained. The estimated average depth of concrete column member using Impact Echo method was 304mm for IEC-300, 398mm for IEC-400, and 484mm for IEC-500, and the relative error rate compared to the actual size was 1%~3%, showing that they were relatively in agreement.

In this study, the estimation of concrete column member depth was executed using the Impact Echo method which is one of the non-destructive methods, and the error rate against the actual depth was found to be 1%~3% showing that they were relatively in agreement, and also the applicability in steel concrete structure could also be confirmed.

### Biography

Yongtaeg Lee is a Professor at the Hanbat National University (Korea). He is member of the Architectural Institute of Korea (AIK), Korea Concrete Institute (KCI) and Korea Institute for Structural Maintenance Inspection (KSMI). His research interests include using nondestructive test, diagnosis condition of concrete structures.

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## First-principles DFT study of possible shallow donors in CuO

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In this work, we perform first-principles density functional theory calculations of various n-type impurities in CuO aiming for the large-scale photovoltaic application. We study the formation of isolated n-type defects in CuO through cation (Al, Ga, In, Hf and Zr) substitution. We found that n-type conduction is relatively hard to be induced by single element doping. The most of isolated donors studied have deep transition levels in the band gap and/or high formation energies. The shallowest ionization level is around 0.2 eV below the conduction band minimum for Hf or Zr substitution of copper. We further examine possible shallow donors by the formation of defect complexes in CuO. We found that an intentional codoping the above n-type single dopants with group-I elements generates an empty impurity band below the original conduction band of CuO, due to the mutual passive nature of donor-acceptor pairs. The binding energy of defect complex is large enough to become the most stable defect type compared with its component defects especially in oxygen poor conditions. The ionization energy of excess donor dopants by effective doping the impurity band is largely reduced. Donor-acceptor level interaction is also found to improve the donor level in the range of 0.1-0.2 eV.

### Biography

Yuan Peng is pursuing her Ph.D. degree in the School of Materials Science and Engineering, Nanyang Technological University. She obtained her B.Sc. in physics from University of Science and Technology of China in 2004, and obtained her M.Phil. in physics from Hong Kong University of Science and Technology in 2007.

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