

5th International Conference on Environmental Toxicology and Ecological Risk Assessment

September 12-13, 2016 Phoenix, USA

Development of glass bead retro-reflective envelope to mitigate the urban heat island and reduce building energy consumption

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Heat from buildings accounts for approximately half of urban anthropogenic heat contributing to the urban heat island (UHI). The proportion of heat from building envelopes accounts for approximately 1/3 of the anthropogenic waste heat total in Japan. Highly reflective (HR) and retro-reflective (RR) envelopes are being studied as one solution. RR materials are being applied to building facades instead of HR materials for UHI mitigation. Glass beads are the common main component of RR material. In order to evaluate the influence of glass bead RR materials on UHI mitigation, several types of glass bead RR samples with different refractive indices and different color reflective layers were developed for this study. Their RR angular distributions of reflection intensity were investigated by an emitting-receiving optical fiber system. It showed that the RR characteristic of a glass bead RR sample with a refractive index of 1.9 is more effective than that with a refractive index of 1.5. Additionally, for possible application to building facades, the long-term durability of these samples was also investigated by an outdoor exposure experiment for about 9 months. It showed that both the solar reflectivity and RR characteristics of these RR samples have no significant decrease over that time in the outdoor environment.

Biography

Jihui Yuan holds a PhD in Housing and Environmental Engineering from Osaka City University, Osaka, Japan and performing research mainly on the urban heat island mitigation and building energy conservation technologies at Osaka City University. He has published nearly 40 articles, regarding highly reflective and retro-reflective coating materials applied to building envelopes. He is an Associate Professor at Huazhong University of Science and Technology in China as well as a Researcher at Osaka City University in Japan.

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