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Tetsuya Suzuki
Keio University, Japan

Reuse of PET bottles by coating DLC films

Reuse of PET bottles reduces PET resin usage and waste and contributes to decrease greenhouse gas emission. However, PET bottles tend to absorb smelly and dirty matters into the surface of PET resin unlike glass bottles and it is hard to remove them completely by washing. Diamond-Like Carbon (DLC) coating has possibility to prevent absorption of substances into PET resin surfaces. The performance of DLC coating as a functional barrier for PET bottles in reuse cycle was evaluated. We have recently developed a technique for coating the inner surface of PET bottles with DLC as a gas barrier to protect the contents and these bottles have been commercialized for soft drinks in Japan. In addition, in terms of the resource protection, reusing of PET bottles is expected as beneficial way with recycling. In this study, the usability of DLC-coated PET bottle in reuse process was investigated. For assessing the effect of washing, we repeatedly washed bottles with alkaline solution and then the gas barrier property was evaluated. After 15 times of repeated washing, DLC-coated PET bottle kept its gas barrier property to about one third that of virgin PET bottle. We also evaluated the protection performance of DLC to chemical pollutants. In this study, we prepared polluted virgin and DLC-coated PET bottle with toluene and 1,1,1-tricroloethane, then measured the migration of contaminants into the food simulants, 4% aqueous acetic acid solution and 50% aqueous ethanol solution, with gas chromatography. The result shows that the contaminants migration to the both food simulants from polluted DLC-coated PET bottle was drastically inhibited and its amount was under one-tenth comparing with virgin PET bottle.

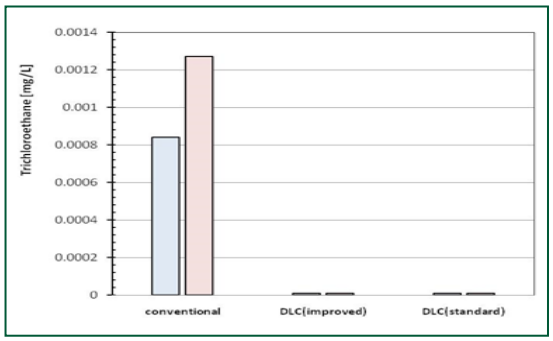

Figure-1: Results of migration test of trichloroethane into the food simulant.

Recent Publications

1. A Shirakura A, Nakaya M, Koga Y, H Kodama, Hasebe T and Suzuki T (2017) Effects of the Ar and He dilution gas mixture ratio on the hardness of a-C:H films synthesized by atmospheric pressure plasma enhanced chemical vapor deposition. *Journal of Vacuum Science & Technology A: Vacuum, Surfaces and Films*; 35(4): 041502.
2. Suzuki T and Kodama H (2005) Diamond-like carbon films synthesized under atmospheric pressure synthesized on PET substrates. *Diamond and Related Materials;* 18: 990-994.

Biography

Tetsuya Suzuki is a Professor in Center for Environments, Resource and Energy at Keio University. He has completed his BSc in Inorganic Materials Science and DEng in Nuclear Engineering from Tokyo Institute of Technology. He was a Leader of several national projects operated by NEDO, JST, Kanto Bureau of Economy, Trade and Industry, Education, Culture, Sports, Science and Technology and Kanagawa Prefecture. His work covers carbon-based thin film coatings, plasma surface modification and DLC-related coatings for medical applications.

tsuzuki@mech.keio.ac.jp