



Tadaaki SHIMIZU, Ph.D.

Professor

Program: Advanced Materials Science and Technology

Area: Applied Chemistry and Chemical Engineering

Undergraduate: Dept. of Chemistry and Chemical Eng.

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Professional Expertise

My professional expertise is to develop conversion processes of various solid fuels, such as coal, biomass, and wastes, to energy such as heat and electricity with low emissions. Experimental works with bench-scale reactors and theoretical studies have been conducted.

Research Fields of Interest

1. Fluidized bed conversion of solid fuels such as coal, wastes, and biomass in environmentally acceptable manner.

I proposed application of alternative bed material with capacitance effect to suppress emissions of dioxins during waste incineration (Figs.1).

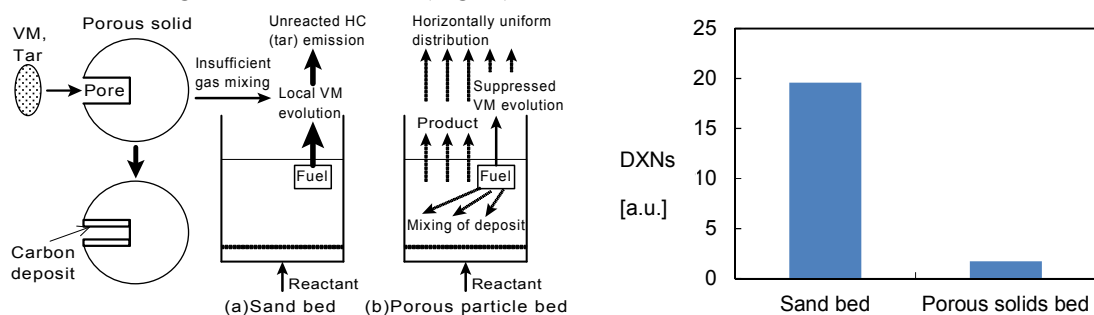


Fig.1 Concept of capacitance effect, behavior of alternative bed material in fluidized bed combustors, and reduction of emissions of dioxins during PVC pellet combustion.

2. Twin-fluidized bed reactor process for CO₂ capture from flue gas using CaO as sorbent.

I am the first person in the world who proposed a CO₂ separation process using CaO as sorbent of CO₂ capture and regenerating CaO by supplying heat by combustion of fuel in pure O₂ (Fig.2). The first publication of this concept has been cited 350 times (as of Apr.19, 2016, data: SCOPUS®). For detail, please read T. Shimizu et al., "A twin fluid-bed reactor for removal of CO₂ from combustion processes", *Trans IChemE Part A (Chem. Eng. Res. Des.)*, Vol.77, pp.62-68, 1999.

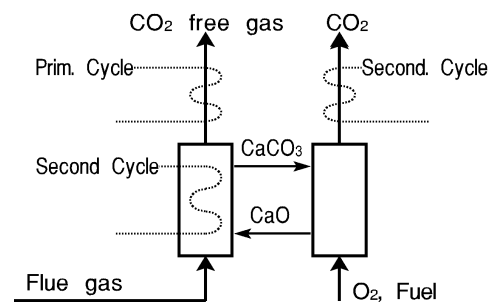


Fig.2 Twin-fluidized bed process for CO₂ capture from flue gas using CaO sorbent.

Education

1994: Ph.D.(Engineering), Course of Chemical Energy Engineering, The University of Tokyo

1985: Master Eng., Course of Chemical Energy Engineering, The University of Tokyo

1983: Bachelor Eng., Department of Chemical Engineering, The University of Tokyo

Professional Societies and Activities

1. Steering committee member of "ISCRE20 20th Int. Symp. on Chemical Reaction Engineering" (Kyoto, Japan, 2008)
2. Chairperson of "The 16th SCEJ Symposium on Fluidization and Particle Processing" (Niigata, Japan, 2010)
3. International Advisory Board of the 10th Int. Conf. on Circulating Fluidized Bed (Sunriver, OR, USA, 2011)
4. Steering Committee member of 21st Int. Conf. on Fluidized Bed Combustion Conf. on Fluidized Bed Combustion (Naples, Italy, 2012)
5. International Advisory Board of the 11th Int. Conf. on Fluidized Bed Technology (Beijing, China, 2014)
6. Steering Committee member of 22nd Int. Conf. on Fluidized Bed Conversion (Turku, Finland, 2015)

Awards

1. C.Y. Gao, T. Takahashi, A. Yoshizawa, H. Narisawa, T. Shimizu, H.J. Kim, L.Y. Li, "Coal combustion under calcium looping process conditions", SCEJ Fluidization Symposium Award, Fluidization Research Group, Fluid & Particle Processing Division, The Society of Chemical Engineers, Japan, 2014
2. T. Shimizu, C.Y. Gao, H. Narisawa, A. Yoshizawa, Y. Shimazaki, K. Suzaki, H.J. Kim, L.Y. Li, "Coal combustion under calcium looping process conditions", Best Poster Award, The 11th Int. Conf. on Fluidized Bed Technology, 2014
3. T. Shimizu, H.-J. Franke, S. Hori, Y. Takano, M. Tonsho, M. Inagaki, M. Tanaka, "Porous bed material - An approach to reduce both unburnt gas emission and NO_x emission from a bubbling fluidized bed waste incinerator", The Japan Institute of Energy Award for Distinguished Paper, Japan Institute of Energy, 2003
4. T. Shimizu, "Research on emission control of fluidized bed combustion", The Japan Institute of Energy Award for Progress (FY2001), Japan Institute of Energy, 2002
5. T. Shimizu, "A new approach to suppress rapid devolatilization during fluidized bed waste incineration", SCEJ Fluidization Symposium Award, 2000, Fluidization Research Committee, The Society of Chemical Engineers, Japan, 2000

Major Publications

Papers

- [1] T. Shimizu, A. Yoshizawa, H.-J. Kim, L.-Y. Li, "Formation of CO and CO₂ in carbonator and NO_x in regenerator under calcium looping process conditions", *J. Chem. Eng. Jpn.*, Vol.49, No.3, pp.294-299, 2016
- [2] T. Shimizu, Y. Matsuura, A. Yoshizawa, Y. Shimazaki, T. Shimoda, H.-J. Kim, L.-Y. Li, "Reduction of NO_x by char under condition for carbonator of calcium looping CO₂ capture process", *J. Jpn. Inst. Energy*, Vol.94, pp.841-850, 2015
- [2] C. Gao, T. Takahashi, H. Narisawa, A. Yoshizawa, T. Shimizu, H.-J. Kim, L.-Y. Li, "Coal Combustion under Calcium Looping Process Conditions", *Fuel*, Vol.127, pp. 38-46, 2014
- [3] C. Gao, T. Higuchi, A. Yoshizawa, T. Shimizu, H.-J. Kim, L.-Y. Li, "Role of Char in NO_x Formation during Coal Combustion at a Regenerator Temperature of Calcium Looping Process", *Fuel*, Vol.121, pp.319-326, 2014
- [4] J.J. Saastamoinen, T. Shimizu, A. Tourunen, "Effect of attrition on particle size distribution and SO₂ capture in fluidized bed combustion under high CO₂ partial pressure conditions", *Chem. Eng. Sci.*, Vol.65, 550-555, 2010

[5] I.N.S. Winaya, T. Shimizu, Y. Nonaka, K. Yamagiwa, "Model of combustion and dispersion of carbon deposited on porous bed material during bubbling fluidized bed combustion", *Fuel*, Vol.87, No. 10-11, 1974-1981, 2008

[6] I.N.S. Winaya, T. Shimizu, D. Yamada, "A new method to evaluate horizontal solid dispersion in a bubbling fluidized bed", *Powder Technol.*, Vol.178, No.3, 175-178, 2007

[7] I.N.S. Winaya, T. Shimizu, "Reduction of volatile matter evolution rate from a plastic pellet during bubbling fluidized bed pyrolysis by using porous bed material", *Chem. Eng. Technol.*, Vol.30, No.8, 1003-1009, 2007

[8] T. Shimizu, M. Toyono, "Emissions of NO_x and N₂O during co-combustion of dried sewage sludge with coal in a circulating fluidised bed combustor", *Fuel*, Vol.86, No.15, 2308-2315, 2007

Book Chapters

- [1] Shimizu, T., 2013, *Fluidized bed technologies for near-zero emission combustion and gasification* (Woodhead Publishing), Chap. 15 "Pressurized fluidized bed combustion", pp.669-700