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EDITORIAL

Special Issue of Plasma Chemistry and Plasma Processing Scale-Up of Plasma Reactors for Bio, Chemical, Environmental, Materials, and Energy Applications

Selma Mededovic Thagard[1] · Bruce R. Locke[2]

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The scale-up of plasma reactors for bio, chemical, environmental, materials, and energy applications is an active area of research and development [1, 7]. Based upon the successful scale-up of dielectric barrier plasma technology for ozone generation [4] as well as corona discharges for many applications in flue gas treatment (starting with the early work, for example, of Gallimberti [2] and Katsura [3]) the prospects for scale-up for other applications are very promising. We have gathered here a few papers dealing with plasma reactor scale-up by several leading groups. Rabinovich et al. [6] discuss the scale-up of gliding arc reactors, which combine elements of thermal and non-thermal plasma, to 15 kW, for applications in hydrogen generation from syngas from a variety of biological and waste materials, exhaust gas treatment, water treatment, and fuel desulfurization. Professor Okubo and his collaborators [8] have developed a highly efficient and innovative process for SO_2/NO_x treatment from exhaust gas based on ozone generation by a dielectric barrier discharge reactor (77 kW) and which produces valuable byproducts. The ozone converts NO to NO_2 and SO_2 reacts with a NaOH solution to generate Na_2SO_4 which is collected as dry particles and used in glass manufacturing. Dr. Okubo [5] also provides a valuable review describing the overall progress in the scale-up of hybrid systems that combine plasma reactors for removal of NOx and wet-lime gypsum for SO_2 removal. The overall message is that the combination of plasma with other process may be the key to developing highly efficient and larger scale industrial applications. While the plan for this special issue included many other possible contributions, the exigencies of the current pandemic may have affected the contributions of others. We remain optimistic that plasma reactors will continue to develop and scale-up issues will be addressed for future applications.

✉ Bruce R. Locke
locke@eng.famu.fsu.edu

Selma Mededovic Thagard
smededov@clarkson.edu

[1] Department of Chemical and Biomolecular Engineering, Clarkson University, 8 Clarkson Avenue, Box 5705, Potsdam, NY 13699, USA

[2] Department of Chemical and Biomedical Engineering, FAMU-FSU College of Engineering, 2525 Pottsdamer Street, Tallahassee, FL 32310, USA

References

1. Brandenburg R, Bogaerts A, Bongers W, Fridman A, Fridman G, Locke BR, Miller V, Reuter S, Schiorlin M, Verreycken T, Ostrikov K (2019) White paper on the future of plasma science in environment, for gas conversion and agriculture. Plasma Process Polym 16(1):e170023
2. Gallimberti I (1988) Impulse corona simulation for flue gas treatment. Pure Appl Chem 60:663–674
3. Katsura S, Kim HH, Takashima K, Mizuno A (1999) Non-thermal plasma technology for gas treatment. In: Inculet II (ed) The modern problems of electrostatics with application in environment protection. Kluwer, Netherlands, pp 161–180
4. Kogelschatz U (2003) Dielectric-barrier discharges: their history, discharge physics, and industrial applications. Plasma Chem Plasma Process 23(1):1–46
5. Okubo M (2022) Recent development of technology in scale-up of plasma reactors for environmental and energy applications. Plasma Chem Plasma Process. https://doi.org/10.1007/s11090-021-10201-7
6. Rabinovich A, Fridman A, Sales C (2022) Scaling up of non-thermal gliding arc plasma systems for industrial applications. Plasma Chem Plasma Process. https://doi.org/10.1007/s11090-021-10203-5
7. Weltmann K-D, Kolb JF, Holub M, Uhrlandt D, Simek M, Ostrikov K, Hamaguchi S, Cvelbar U, Cernak M, Locke B, Fridman A, Favia P, Becker K (2019) The future for plasma science and technology. Plasma Process Polym 16(1):e1800118
8. Yamasaki H, Mizuguchi Y, Nishioka R, Fukuda Y, Kuroki T, Yamamoto H, Okubo M (2022) Pilot-scale NO_x and SO_x aftertreatment by semi-dry plasma-chemical hybrid process in glass-melting-furnace exhaust gas. Plasma Chem Plasma Process. https://doi.org/10.1007/s11090-021-10193-4