Guest Editorial

Why is R&D in Drying a neglected area ?

Prof Arun S Mujumdar

Drying, in general perception, is a "dry" subject. It is not easy to be excited about the subject, perhaps because it is easy for a lay person to visualize what drying means. The man on the street, even an engineering researcher or graduate student for that matter, is quite familiar with the clothes dryer, the hand dryer in washrooms, and the ubiquitous hair dryer, etc. Thus, it seems unnecessary, even impertinent, to claim the need for R&D in drying. What really is there to know ? Are we not drying everything that needs drying?

I am often asked the reason why R&D in drying is a neglected area, a sort of orphan in the R&D community. Let me take a humorous look at this problem so that I can avoid being labelled a "dry" or a bore. The opinions expressed here are only my personal views and many readers may not agree with these; in fact, I hope they don't fully agree and have their own independent thoughts on this "dry" subject.

From the word 'go', people into R&D in drying are trying to go against the tide. People, not unlike typical researchers, are intrigued by things they cannot visualize, e.g., things of micro or nano or even angtrom scale. Researchers are further attracted by big research grant potential; academic institutions are even institutionalizing this basic instinct into promotion and tenure guidelines. Good and useful drying R&D, lamentably, can be carried out without needing large laboratory space and huge research grants. Researchers, veering like a weathercock in the direction of prevailing wind that may bring a grant windfall, will find it difficult to be excited about doing complex transport phenomena and material science research that they may not fully resolve in their lifetime. For example, a researcher trying to develop a unified drying theory or a fundamental model that can reliably predict the drying performance of a

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Dr Arun Sadashiv Mujumdar is a globally renowned expert on drying. He is currently Professor with Engineering Science Program & Dept of Mechanical Engineering at the National University of Singapore. He is also Adjunct Professor, Dept of Chemical Engg & Agricultural Engineering & Biosystems at McGill University, Canada.

There are few scientist engineers as distinguished as Prof Mujumdar in the field of drying. Prof. Mujumdar did his BChem (Engg) with distinction from UICT, Mumbai and then his MEngg and PhD from McGill University. He has won major awards and honours for his achievements in chemical engineering, particularly drying. He has authored several books on industrial drying, the last one which Chemical Industry Digest reviewed was on Handbook of Industrial Drying - 3rd Edition, CRC Press (Chemical Industry Digest - vol.XX.4, April, 2007). A prolific writer, he has written several articles on drying, some of which, Chemical Industry Digest was also fortunate to publish. He is the Editor-in-Chief of the international journal, 'Drying Technology' and is on the Editorial Board of many journals.

Full details of his achievements are available on the websites: www.geocities.com/AS_Mujumdar and http://Serve.me.nus.edu.sg/arum/

Undoubtedly, a guest editorial from Prof Mujumdar has to be duly reflected upon by all our readers.

large spray dryer can only hope to make incremental advances unless one is very naïve, of course. The deceptively simple problem of drying can be a very complex, one that may require decades of serious effort.

Even in the Oxford English Dictionary, the literal or idiomatic meaning of the word 'dry, drying' have no positive connotation. Yet, almost everything we need and use everyday, has undergone the energy-intensive process of thermal drying. The paper we use, even in this so-called paperless world, is a result of a massive dehydration process, consuming up to 35% of energy used in papermaking; this process is more energy-intensive than steelmaking. Energy audits in various developed countries, e.g., Canada, France, UK, Germany, Denmark, have shown that 13-20% of their national industrial energy consumption goes into thermal drying operations. Fossil fuels provide almost all of the energy needed. With industrial dryer efficiencies ranging from just 30 to 60%, a lot of energy literally goes up the stack. The resulting environmental impact through greenhouse gas emissions is also massive. If countries adopt caps on carbon emissions, such as the one recently adopted by U.K. to reduce CO_2 emissions by 50% from their 1990 level by 2050, there is no doubt every drying operation will come under scrutiny. It will be impossible to achieve such a target without revamping the drying operations in every industry.

Although no university is in the business of designing, selling or using industrial dryers, they are doing most of the R in drying R&D today, without interaction and tangible support of industry. Of course, there are major exceptions that prove the rule. This is not a sustainable model in the long run for an applied multidisciplinary area such as drying. Proactive industrial support is the key to the future of drying R&D in academia. Technology transfer can occur only with active participation by industry and appropriate government agencies. Real, rather than imaginary problems, need to be addressed by academia so that their research is not of just 'academic' interest.

This brings up another issue faced by academics, whose research output is often infected by the well-known "changing goal posts syndrome." Over the past three decades models, used to assess research productivity and value, have changed greatly, mainly as a result of the digital age. First, it was simply the number of papers published, then it was both the numbers and some indicators of impact or quality, and now it is the perceived impact of the research as measured by massive data processing operations. Now, we want research papers to appear in high "impact factor" journals. This does not mean there is real impact of the work for societal good; if the work leads to more papers and the chain goes on ad infinitum, it is thought to be somehow more impactful. Citations beget more citations. This model weakens and even distorts the fundamental engineering research dissemination process. Often, there is the tendency to publish in applied physics or chemistry journals when the work, infact, belongs to engineering. This is because the former usually have higher impact factors and they publish papers very rapidly relative to the engineering journals. Engineering R&D should be expected, rightfully, to find its way into practice and not necessarily into another paper. A cynic could conclude, in fact, that excessive citations for an engineering paper may mean incomplete work or simply that the work is truly of "academic" interest.

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It is hoped that academics in search of challenging research problems will also look at the needs of the "drying" community. A lot has already been published. A number of truly challenging problems have been recognized but there are no takers for them yet. Currently, the global drying community has a sustainable critical mass but young blood needs to enter the field and apply their talent to solve real world problems. They can make useful contribution as the world faces new energy and environmental challenges. Instead of jumping on the research bandwagons created by others, they should create their own new bandwagons and attract others to jump in! It is not easy; it is much easier to join a well-heeled bandwagon but in an already crowded wagon, one is unlikely to be noticed. I hope this analogy will encourage some young researchers to make their own "drying mini-bandwagon.".