

SHS 2011

DECLARATION

To be published in SHS Journal

VISION FOR THE FUTURE OF COMBUSTION SYNTHESIS

- 1) Combustion synthesis of materials (CS), including SHS, without any doubt has reached an advanced mature stage and has a wide range of viable industrial applications. But it is also clear that industry in general is *not* in general fully aware of CS and its advantages. This lack of awareness is a serious obstacle in CS becoming widespread, benefiting industry and the economy. A number of approaches are available to address this problem.

A proactive search for industrial needs and demands (often locally important) will highlight areas where CS can offer solutions. A good example of this is Valencia University in Spain which has become very successful in industrial collaboration by being proactive in this sense. Another effective way is via industry-guided collaborative consortia for research (e.g. with EC or NSF funding). The Int. Symposia on SHS should try to increase industrial participation. Industrial companies that can benefit from CS should be targeted. Exhibitions of proven CS technologies and products during symposia and conferences.

It is crucial however that CS should only be offered as a potential solution to an industrial challenge when it is clearly *suitable* and offers strong added value. The proactive approach needs to be aimed carefully.

“Dissemination of Combustion Synthesis and its advantages for industrial production must be a priority, but it must be aimed carefully where Combustion Synthesis can offer strong added value.”

To help dissemination of CS to industry, the SHS Association should collect and publish information on industrialisation success stories of CS. It should engage experts to compile market analyses and market needs for different sectors, whenever possible.

- 2) Opening-up to industry needs to be accompanied by a general improvement of public awareness, perception and knowledge about CS. Therefore popularization of achievements and capabilities is necessary. Use of www for dissemination of activities and successes in CS/SHS is a powerful conduit. In particular, CS should be shown to be a proven, viable processing method and this needs to enter educational curricula worldwide. Whenever possible, CS and SHS need to be taught to undergraduates as a feasible and often superior alternative to traditional processing methods for materials' synthesis. Text books (in English) need to be prepared (perhaps translated and adapted from Russian when available) and made available worldwide via international publishers.

“Combustion Synthesis needs to be taught widely at an undergraduate level as a viable alternative to many traditional synthesis processes”

- 3) For more advanced needs, specialist books with up-to-date specialist reviews of various areas of CS should be prepared and published internationally for the benefit of new researchers and PhD students entering the field. Review articles on CS should be published in wide-readership journals. The SHS Journal, lately with much increased circulation and recognition is excellent for reporting the details of the process, but it is not ideal for reporting the actual achievements of CS/SHS. The International Combustion Conference should always include a CS section.

“Specialist reviews of CS should be prepared in English by leading experts and published worldwide. CS should be a section in the Int. Combustion Conference”

- 4) Popularisation should be accompanied by clarity. Whereas “Combustion Synthesis of Materials” is clear, “SHS” appears to be difficult to understand at a lay level and it should be always accompanied by “CS” since it is a specific regime of CS. The same for Solution Combustion Synthesis and other special regimes of CS/SHS
- 5) New directions of CS should be sought, perhaps guided by inadequacies and failings of traditional industrial processing methods. Directions should be strengthened by collaborations between groups. Specialised sub-meetings during Int. SHS Symposia help. Industrial collaborations will offer new insights. Important to encourage and fund groups of specialists covering the whole range of needs to solve specific challenges: theoreticians, developers, implementers and end-users.

Areas of strong potential for CS:

Industrial sectors that CS can contribute significantly include:

- ENVIRONMENT: reduction of wastes and pollution, catalysts, recycling, neutralisation, remediation etc)
- SAFETY (fire, nuclear, hydrogen etc),
- ENERGY (new materials, storage, process savings etc)
- ELECTRONICS (
- SPACE (In situ resource utilisation, TPS etc)
- Important to answer many fundamental questions regarding CS in order to allow predictions and potential future directions.
- The development of new, less polluting technologies, utilization of wastes and processes for the production of energy and materials must be given the highest priority
- High energy materials and electronic materials (phosphors, silicon, piezoelectrics, etc)
- Reduce ignition temperature (Mechanical activation etc)
- Space technology because of its multiple demands for materials and technologies can be uniting for combustion synthesis specialists. Reactions in vacuum, without loss of heat when adiabatic

conditions can be easily achieved and limit concentrations are different, we have to know them for future space development. SHS in vacuum is a very prospective direction.

- Centrifugal synthesis is one priority research direction, it is a solution for continuous production. It is very important to study the mechanism of centrifugal synthesis
- SHS nanomaterials - very critical research direction.
- Layered composite materials formed under pressure. Bonding, coating technologies
- For catalysts high priority studies of natural gas conversion to valuable products, to develop SHS catalysts for conversion of CO₂, coal to liquid fuel, etc