R020001 v04 (2016)

Fine Bubble Technology in the EU

This study documents the commercial, academic and innovation activity in the area of fine bubbles technology for the geographic area limited by countries in the European union (EU29). Special attention is paid to evaluate the types of technology applications, the related bubble sizes and the required needs for metrology in different countries in the EU29 area. Trends were identified and predictions were made for the country-by-country development of fine bubble technology up to 2030.

Table of Contents

Forward

This report was initiated and supported by the Fine Bubble Industries Association (FBIA).

FBIA has full rights to use any part of this report or information within for its own purposes.

This report of 107 pages contains 82 Figures, covers 29 Countries and estimates market over 2014-2030 period. Some 134 Organisations are listed to have their activity in the fine bubble technology.

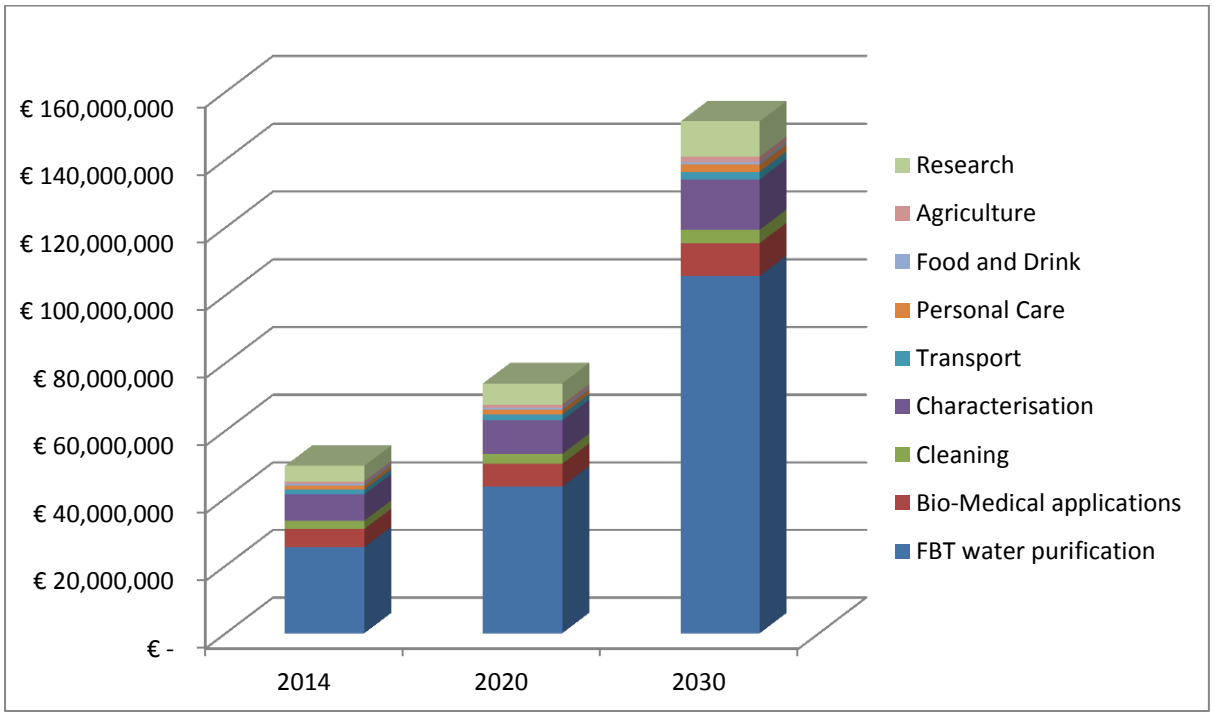
For more information on pricing and availability of the report please contact Dr Denis Koltsov on denis@brec-solutions.com

Summary

This report evaluated 29 European member states and identified over 134 organisations working in the field of fine bubbles. The size of the EU market was evaluated from commercial data available for the 2014 year. The size was found to be €48.5 million in 2014 and was projected to increase to €71.7 million by 2020 and to €144.8 million by 2030. The EU market for fine bubble technology was found to be dominated by the water treatment sector with over 52% of the total (Figure 23). Bio-medical, research and characterization areas of activity are the most promising areas after the water treatment. It should be noted that UK specializes in characterization, Germany on water treatment and France is relatively well balanced. The FBT activity is projected to grow nearly 3 times in the period of 2014 to 2030. The greatest growth will be in water treatment area due to geo-political and resource management reasons. The EU member states ranking plotted in Figure 28 highlights the growth in each member state and the fact that Germany, France and the UK would maintain their lead.

From the results of the academic literature search the academic publications are said to increase by 120% from 2014 to 2025. This report makes a point that academic publications are not always aa good measure of commercial innovation. For this reason patent data was used. EU patent filings tend to increase from year to year with an approximately 50% growth projected from 2015 to 2025. The EU-owned patents follow a completely different data trend. The data indicated a decline from 2007 that should reach the lowest point in 2021.

In 2014-2015 the three biggest contributors to characterization and metrology in the EU were UK, Germany and France with the UK overtaking Germany by nearly 3 fold. The provision of national metrology centres and the supply of state of the art characterization equipment was found to be strong in Germany and France but was exceptional in the UK. The UK was seen as a leader in characterization equipment and metrology and contributed over 50% of the EU's output in that field. This area is likely to double by 2030.



BREC Solutions Limited, 43 Bank Road, Lancaster, LA1 2DG, UK. Tel: +44 7887 931 658 denis@brec-solutions.com , www.brec-solutions.com

1. Introduction

Recent trends in innovation, research and search for new applications around the world set a number of priorities in terms of new products and services. More eco-friendly products are being required by the market as the general public is trying to reduce the use of energy or harmful chemicals. For example cleaning services are now aiming to be more nature-friendly by using less detergents (that end up being released to the environment). Higher agricultural production has been the focus of international food-producing industries for many years. The reliance on fresh water resources or the remediation of spoilt water resources due to pollution is the priority in a number of developed and developing countries.

Due to a better health service we live longer and this changes demographics and life expectancy especially in the developed world. This in term requires more and more personalized medical care with a great reliance on non-invasive diagnostic techniques such as ultrasound scans or tomography. Personal care for skin, hair and teeth are in the top priority list for the large pharmaceuticals and care providing companies.

The ecological transportation and the use of resources such as coal or metal ore extraction or fresh water treatment are on the list of top priorities for the World Economic Forum (2015) discussions. Availability of fresh water especially for the third world countries has been the priority number one for decades.

All these discussion are affected by the technology that some call gas bubble technology but the new term is “fine bubble technology”. This area of development brings together a number of technologies from agriculture, aquaculture, cleaning, transport, bio-medical, pharmaceutical, food, drink, water purification, mineral extraction by flotation and more. Fine bubbles technology is a horizontal technology similar to biotechnology that affects a great number of independent sectors by its implementation.

The origin of this technology can be tracked to the developments in physics of cavitation and fluid dynamics. The processes of bubble generation and use are not simply dynamic. Due to recently documented stability of fine bubbles, their numbers and size distributions may be characterized using modern equipment. The effects as well as the presence of these bubbles are now the focus of a growing community looking at improving existing industrial processes, consumer services or products. This report aims to evaluate the level and breadth of this activity in the European Union (EU29). The EU29 was taken as a list of 29 countries[1] including Norway.

Methodology

Copyrighted content.

[1] EU29 was considered as an expanded list of countries: Austria (AT), Belgium (BE), Bulgaria (BG), Croatia (HR), Cyprus (CY), Czech Republic (CZ), Denmark (DK), Estonia (EE), Finland (FI), France (FR), Germany (DE), Greece (GR), Hungary (HU), Ireland (IE), Italy (IT), Latvia (LV), Lithuania (LT), Luxembourg (LU), Malta (MT), Netherlands (NL), Norway (NO), Poland (PL), Portugal (PT), Romania (RO), Slovakia (SK), Slovenia (SI), Spain (ES), Sweden (SE), United Kingdom (UK)

2. Useful definitions

The field of fine bubbles has a very lose terminology. Different application fields use contradictory definitions ranging from “nanobubbles” while referring to bubbles of the size of a few microns to “ultra-fine bubble aeration” where (in some cases) the bubble sizes are much greater than those defined by ISO under that term.

ISO has developed a number of definitions that will be used in this report.

fine bubble - bubble (2.1) with a volume equivalent diameter of less than 100 µm

Note 1 to entry: 100 µm is also represented as 1 x 10-4 m.

ultrafine bubble - fine bubble (2.2) with a volume equivalent diameter of less than 1 µm

Note 1 to entry: Examples of ultrafine bubbles, measured in water by particle characterisation methods, range between 100 nm and 200 nm.

Note 2 to entry: Nanobubbles are a part of the range of ultrafine bubbles.

microbubble - fine bubble (2.2) with a volume equivalent diameter in the range from 1 to 100 µm

Note 1 to entry: Figure 1 shows the ranges in size of bubbles, fine bubbles, ultrafine bubbles, and microbubbles.

The term “nanobubble” was considered not appropriate for the technical definitions developed at ISO TC281 committee. In the making of this report the term “microbubble” or “nanobubble” were used and evaluated independently so that to avoid excluding statistics that may be due to an inaccurate use of terminology by the existing users. All papers of patents containing these terms were included in the study.

3. Technology

Copyrighted content.

.

.

.

10. Index

BREC Solutions Limited, 43 Bank Road, Lancaster, LA1 2DG, UK. Tel: +44 7887 931 658 denis@brec-solutions.com , www.brec-solutions.com

11. References

1. *An ultrasonic technology for production of antibacterial nanomaterials and their coating on textiles.* **Anna V. Abramova, Vladimir O. Abramov1, Aharon Gedanken, Ilana Perelshtein2 and Vadim M. Bayazitov1.** 2014, Beilstein J. Nanotechnol, Vol. 5, pp. 532–536.

2. *Ultrasound-assisted coating of nylon 6,6 with silver nanoparticles and its antibacterial activity.* **N. Perkas, G. Amirian, S. Dubinsky, S. Gazit andA. Gedanken.** 3, 2007, Journal of Applied Polymer Science, Vol. 104, pp. 1423–1430.

3. *Ultrasound-assisted coating of polyester fiber with silver bromide nanoparticles.* **Raziyeh Moosavia, Amir Reza Abbasib, Mohammad Yousefia, Ali Ramazanic, Ali Morsalib.** 6, 2012, Ultrasonics Sonochemistry, Vol. 19, pp. 1221–1226.

4. **Bang, Jin Ho.** *Nanostructured Materials Prepared with Ultrasound PhD thesis.* Illinois, USA : University of Illinois, 2008.

5. **EUROPEAN COMMISSION.** Action plan against the rising threats from Antimicrobial Resistance. [Online] 15 11 2011. [Cited: 13 11 2015.] http://ec.europa.eu/dgs/health_food-safety/docs/communication_amr_2011_748_en.pdf.

Contact

Denis K. Koltsov (MA, MSci, MPhil, PhD)
Director and Principal Consultant
BREC Solutions Limited, 43 Bank Road, Lancaster, La1 2DG, UK
tel: +44 7887 931 658
email: denis@brec-solutions.com
www.brec-solutions.com