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1 Introduction

Profile of the International Membrane Industry – Market Prospects to 2008 is a third edition of Elsevier’s series of profiles of the filtration membrane business, the first of which was published in 1996. It is also part of wider set of profiles that deal with the filtration and other fluid handling industries published by Elsevier.

As the term is generally understood, there are two broad types of membrane:

- those designed to keep two distinct zones completely separate, allowing no fluid passage through them. Examples include geomembranes, the damp proofing under a house, and, the base of a landfill site. Such membranes are not covered by this Profile; and,
- those designed to permit passage through them of a fluid, or some components of a fluid, under controlled conditions. Such membranes are fully covered by this Profile and represent its total content.

1.1 Scope of Profile

This Profile of the International Membrane Industry – Market Prospects to 2008 is basically a market study. It has been researched and compiled through personal and telephone interviews with key manufacturers, literature searches, detailed analysis of published statistics, and desk research using Elsevier Advanced Technology’s extensive in-house database covering the international filtration and separation industry.

The research was undertaken between May and October 2003. As a result of this research, a set of market volume estimates has been made based on the state of the market in 2003. Forecasts are then provided through to 2008.

The Profile deals with all the kinds of separating media that are now
accepted as membranes, whether they are polymeric, ceramic, metallic or liquid. The present chapter defines the scope of the Profile and its contents, and then supplies a brief overview of the worldwide economy as it was in the middle of 2003. This provides the context for the geographical market forecasts and estimates of the following chapter.

Chapter 2 deals with the nature and size of the international membrane market, illustrating the structure of the industry, identifying key features of the market, and giving detailed estimates and forecasts of the market in the five continents and their constituent parts. Market size estimates are given for 2002 and 2003, plus forecasts of market size for 2004–2008. Brief economic notes are given for the same market areas.

Chapter 3 looks at the membrane processes themselves, the ways in which membranes are used, examining the markets for each of the major membrane processes as applied in industry.

Chapter 4 examines the end-use markets for membranes, looking at each of the major destination industries and their trends as they apply to the membrane marketplace.

Chapter 5 looks at the technical aspects of the membrane market and examines the trends that are likely to make a mark in the immediate future.

Chapter 6 lists the main corporate changes in the membrane production and supply industry since the last edition of this Profile.

Chapter 7 contains profiles of 30 leading international suppliers of membranes.

Chapter 8 is a directory of more than 400 manufacturing companies worldwide.

Chapter 9 contains a listing of relevant associations and societies, as well as a currency exchange rate table.

This Profile makes no attempt to be a textbook on membrane technology. For that function, the reader is directed to any of a number of recent books, especially Keith Scott’s *Handbook of Industrial Membranes*, published by Elsevier Advanced Technology.

1.2 Membrane Processes

The review upon which this Profile is based has covered the worldwide market for membranes as used in a wide range of separation processes. In broad terms, the study looked at:
- reverse osmosis (RO) – the original process using separation membranes, separating ions and other dissolved materials from water. It is the process with the highest pressure for separations of materials with a critical size below 0.001 μm (although particle size is not really relevant to RO). The study also looked at nanofiltration (NF), a rapidly growing sector of the process spectrum, a looser form of reverse osmosis;
- ultrafiltration (UF) – the medium-pressure separation, of mainly larger molecules from fluids, in the size range 0.1 μm to 0.001 μm;
- microfiltration – the separation of solid particles from fluids at quite low trans-membrane pressures where the solid particle size lies between 10 μms and 0.1 μm;
- all others membrane separations in the liquid phase, many of which operate by diffusion through the material of the membrane rather than through pores, and which may use driving forces other than physical pressure; and,
- gas or vapour separation processes.

The Profile thus looks at all applications of membranes, concerned with separations involving both liquids and gases.

1.3 Market Estimate Analysis

The total world market estimated for 2003 is given in Chapter 2, together with its geographical breakdown by major national market or by region. The forecasts through to 2008 are given in the same way, together with a historical estimate for 2002. The geographical breakdown features all five continents, with detailed analyses for three of them, especially Europe.

The world market is analysed and described in terms of the five main membrane process categories (RO/NF, UF and MF, other liquid phase processes, and, gas separations) in Chapter 3, with further development of the ‘other liquid separations’ category.

The market is further analysed in Chapter 4 by its main end-user industry categories to highlight where the major developments in the market are expected to be.

The membrane process and end-user analyses of the market are given with the same history from 2002, and forecasts through to 2008, as are the geographical segments.
1.4 Economic Overview

The world market for any engineering or processing product is likely to be determined largely by what happens in North America, Western Europe and Japan – although the fastest growing parts of the market are expected to be in the developing regions.

The USA is showing signs of steady growth out of its 2001 recession, while Canada and Mexico are likely to keep pace with this growth, since their economies are heavily dependent upon that of their larger neighbour.

The US boom came to a sharp end in 2001, mainly caused by the collapse of the dot.com bubble, and the revelations of bad accounting on a massive scale among a significant number of companies. These factors were then exacerbated by the terrorist attacks of September 11th 2001 and the short Afghan war that followed them.

These events caused a marked change in the US economy, and with it those of much of the developed world. Many of these areas, however, are now sufficiently strong economically as to be able to ride out a faltering of the US economy. The recession in the USA during 2001 surprisingly came to an end in November of that year, and the incipient recovery from 2002, although stumbling a little during the Iraq war of early 2003, seems not to have been stopped. Much now hangs upon how strong this recovery will be.

This Profile adopts the view that the US economy will continue to grow at a moderate rate, slowly pulling some of the other large economies (especially Germany and Japan) out of the doldrums. Because of the slump in the American economy, that of the whole world was close to stagnation throughout 2001 and most of 2002, with recession in some parts of it. This Profile assumes that world output will only show a weak recovery by the end of 2003, with little strengthening until 2004. The period from 2005 to 2008 should then be better years for all concerned.

The economy of Western Europe is being heavily influenced by political events. These include the proposed expansion of the European Union (EU) with 10 additional countries, mostly from the east of the continent, while negotiations are now under way that should lead to a formal constitution for the Union. Meanwhile, the formation of the euro-zone has split the EU into two parts, with current signs indicating that it has not been a great success.

The economy of Western Europe has been affected by the continuing weakness of Germany, which is holding back that of the whole euro-zone. The four countries in the region that are outside of the euro-zone
are currently doing rather better in economic terms than many of those inside it. Reflation of the economy, and a reduction in the high levels of unemployment are the major problems for the immediate future.

Eastern Europe as a region is dominated by Russia, both economically and geographically. It has recovered well from the problems of a few years ago, and Russia in particular is expected to continue to grow quite fast economically. The potential output from the region is much larger than is presently being achieved, and much still depends on accession by many of the smaller countries to the EU.

The Eastern Asian segment contains the large economy of Japan, the large population of China, the Koreas and Taiwan. The economic crises of the late 1990s are now a thing of the past, but they have had a severe impact on Japan. The country has not recovered at all, but rather has suffered several periods of recession. By contrast, China continues to grow very rapidly, and this growth is expected to continue over the forecast period for this Profile. The smaller countries in the region have economies dominated by exports, and the varying fortunes of their larger neighbours will be reflected in them. At one stage the Severe Acute Respiratory Syndrome (SARS) epidemic threatened to destabilize the whole area, but fortunately the disease was brought under control quite quickly.

South East Asia has recovered well from the economic disturbances of several years ago, and some of the economies are growing quite rapidly. However, some of the countries have considerable political problems with which to deal, and these are hindering economic growth, partly by causing a reduction in foreign investment in the region. Once these problems are resolved, then the economic potential here is considerable.

South Asia covers the very populous states of India, Pakistan and Bangladesh, all with very low figures of Gross Domestic Product (GDP) per capita. Business potential here is enormous, but the area is sadly lacking in investment and still very troubled by inter-religious strife.

The Central and South American region continues to be affected by political turmoil and economic problems, although the change of government in Brazil seems to have settled the largest country in the region. Some of the other problems appear intractable, resulting in a reduction of foreign investment.

The Middle East, including Turkey and the ex-Soviet republics of the Caspian Sea area, also presents considerable contrasts. The oil and gas rich states are fending off political change, while the continuing conflicts in Palestine, Afghanistan and now Iraq are causing great concern for the future. Turkey’s hopes of entrance to the EU suffered a setback in the recent negotiations, leaving it in an uncertain position. The region’s oil
and gas reserves make it a key source of energy for the developed world, so renewed investment can be expected to occur.

Africa is a huge region, containing severe local area conflicts, but with great potential, once the investment climate becomes more attractive. It is a continent of extremes, with a comparatively rich zone along the Mediterranean Coast, and intense poverty around the Equator.

The Australasian region is dominated by Australia, which has been growing well of late, despite the severe drought in parts of the country and the problems of the world around it.

On the world scale, apart from a few unfortunate exceptions, a major change of recent years has been the marked reduction in rates of inflation, especially in the developed parts of the world. For most of Western Europe, the current inflation rate is close to zero, while that in Japan has been negative for two years. The problems of deflation, and its different risks, may well persist for a year or two yet.

Despite most of the fears expressed for the immediate future, the markets for much of the membrane industry will remain firm. Most applications for membranes are in rapidly expanding industry sectors, so that the future for the industry looks very good, despite the economic problems awaiting resolution. Interest rates are at their lowest levels for several decades, so the cost of investment in plant and equipment is low, and such investment is attractive.

Current estimates of world GDP growth suggest a rate of 3.2% by the end of 2003, and 4.1% for 2004 (up from 2.4% in 2001 and 3.0% in 2002). This is almost twice the level forecast for the advanced economies, including the USA, which are/were forecast to be 1.0% in 2001, 1.8% in 2002, 1.8% in 2003 and 2.9% in 2004. This Profile assumes that global growth will settle at around 3.0 to 3.5% during the next five years.