
Growth Prospects for Spectroscopy Techniques to Converge in 2004

The Spectroscopy Market Continues Its Expansion in Both Mature Markets and New Application Areas

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It was somewhat of a strange year for the laboratory analytical and life science instrument industry as recently strong growth sectors such as pharmaceutical and biotech slowed, while metals production and fabrication, chemicals manufacturing, and even the semiconductor industry, began to recover from a prolonged period of malaise. Overall, 2003 was very much like 2002 in terms of total growth, but the mix certainly was different.

According to *Instrument Business Outlook (IBO)*, a publication of Strategic Directions International, Inc. (SDI; Los Angeles, CA), the total worldwide market for analytical and life science instrumentation and related aftermarket and service revenues approximated \$25.4 billion for 2003, growing at about 6.8% from revenue levels in 2002. Full-year performance would have been even lower if the second half of 2003 had not shown such strength, which bodes well for 2004. Many factors contributed to mute the expected upsurge in demand for most businesses, including the instrumentation industry. Slow growth in Europe, fluctuating exchange rates, political and economic uncertainties surrounding the conflicts in the Middle East, and terrorism in general might have caused both the private and public sectors to hold back on expenditures with a wait-and-see attitude. SDI's projection for 2004 suggests about the same level of growth, 6.9%, with a continuation of the trends seen in 2003.

Investment in Emerging Markets Is Among Key Trends

The year 2003 was characterized by a number of important trends and developments that affected the instrumentation marketplace. Perhaps most significant was the recognition of the growing importance of China as a major market and a manufacturing base. China's growth has been remarkable and companies from around the world are eagerly investing, and causing a shift in demand for sectors of instrumentation. This is especially true for heavy manufacturing, but also for pharmaceuticals and electronics. And right next door to China is India, the nation energized to play its role on the world's stage, especially in IT consultants, customer support, and pharmaceutical manufacturing.

Interest in enhanced customer support and service was not only of interest to India. Instrument companies have embraced this area as a source for enhanced profitability and revenue growth, not by charging higher prices, but by offering a host of new services including integrated validation services and multivendor support programs. Acquisition activities also increased in intensity in 2003 and should continue this year and beyond. General Electric's (Fairfield, CT) announcement of the pending acquisition of Amersham plc (Buckinghamshire, UK) was the most dramatic, but Thermo Electron (Waltham, MA), Fisher Scientific (Houston, TX), and Waters Corporation (Milford, MA) also announced deals, some of which included consumables and lab equipment businesses, a good adjacent field to instrument manufacturing.

SDI breaks out the spectroscopy market into three distinct sectors: molecular spectroscopy, atomic spectroscopy, and mass spectrometry (MS). The applications of the techniques included in each sector and their prospects differ significantly, even within each sector. Overall worldwide revenues in the spectroscopy area totaled about \$5.6 billion in 2003, or about 22% of the total laboratory analytical and life science instrument market. The overall spectroscopy market is estimated to have grown about 5.3% in 2003, actually slightly less than 2002 growth. SDI predicts that the market will expand slightly faster in 2004, growing at about 6.0%.

Molecular spectroscopy techniques account for about 46% of the spectroscopy market, although many diverse techniques are represented. Atomic spectroscopy is the second largest sector at almost 36%, while MS represents just 18% of spectroscopy revenues. Please note, however, that general purpose liquid chromatography (LC)-MS and gas chromatography (GC)-MS, both major MS techniques, are not included here as they are considered to be part of the chromatography market. Revenues of these hyphenated techniques would increase the significance of the MS figures by about 70%. MS then would approach the size of the atomic spectroscopy sector.

Life Sciences Drive the Molecular Spectroscopy Market

The market for molecular spectroscopy is estimated at approximately \$2.6 billion for 2003. There was, however, considerable variance in growth by product technique, led by the robust nuclear magnetic resonance (NMR) segment. Overall, the total revenues for all categories grew 6% in 2003, a nice improvement over 2002. No single technique dominates this market, but three segments, UV/Vis, NMR, and IR, account for over 70% of the overall molecular spectroscopy market.

The primary demand for molecular spectroscopy comes from strong growing life science industries, including the pharmaceutical, biotechnology, organic chemicals, and food industries, as well as academia and government sectors. Molecular spectroscopy techniques have an enormous range of applications, but also experience lower demand in other industries, many of which currently are depressed.

UV/Vis spectrophotometers comprise the largest portion of the molecular spectroscopy market, but also one of the slowest growing segments. Unit sales of visible-only and non-scanning instruments have been declining in recent years, except for environmental testing where such instruments are tied to pre-packaged reagents and kits. In general, faster and more powerful types of instruments, at marginally higher prices, are replacing lower performance instruments.

As in recent years, NMR spectrometers represent the most dynamic molecular spectroscopy technique, with growth for 2004 estimated at over 9%. NMR is an important technique in the analysis of complex molecules such as proteins. Although comprising a small segment of the NMR market, new 900-MHz systems sell for as much as \$5 million each and clearly are spurring overall NMR market demand. Such systems are extremely sensitive and offer scientists at major research institutions an important analytical tool. The NMR market now is poised to overtake UV/Vis as the largest segment of the molecular spectroscopy market.

The Raman spectroscopy market continues to experience strong demand,

Fastest Growing	Slowest Growing
Fourier-transform ion cyclotron resonance 20%–25%	Sector MS –4% to –2%
Quadrupole time-of-flight MS 12%–15%	Fluorescence 1%–2%
Nuclear magnetic resonance 9%–12%	Atomic absorption 1%–3%
High-resolution LC–MS 8%–10%	Arc/spark 3%–4%
Raman 7%–9%	UV/Vis 4%–5%

with 2004 growth expected to approach 9%. Dispersive Raman systems with microscope interfaces currently are the fastest growing products. Raman often is used to inspect for purity and composition of plastics, rubbers, and resins. Raman also is an important technique for the characterization of pharmaceutical excipients. Fiber optic probes also give dispersive Raman systems a degree of portability, which enhances their use in at-line and on-line process settings.

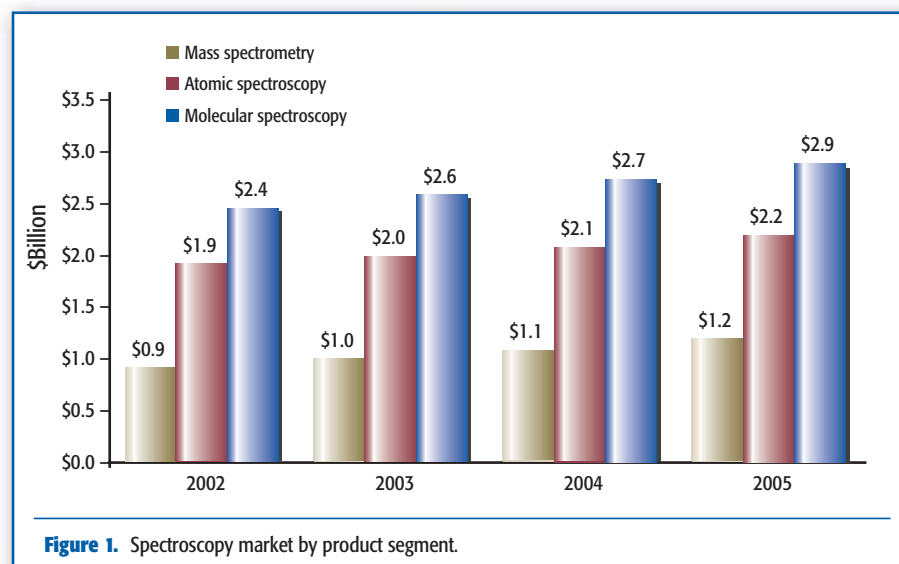
IR and near-infrared (NIR) instruments represent almost 30% of the molecular spectroscopy market, but growth has moderated to around 5% as the techniques have proliferated. Food analysis, especially milk and grains, forensics, plastic recycling, and cellular analysis are important application areas. Color measurement instrument demand picked up slightly in 2003 and should grow at around 5% in 2004. However, major industrial users such as

paints, textiles, and printing have yet to rebound, so prospects for color measurement should improve later in 2004 and into 2005.

The fluorescence market currently offers little growth potential as demand for very simple instruments such as luminometers and filter fluorometers diminishes. Spectrofluorometers and multifunctional fluorometers offer slightly more promise, but demand for microplate readers with fluorescence detection continues to sap interest in fluorescence-based instruments. Biosensors and calorimetry instruments also are competing successfully with fluorescence in applications dealing with molecular interactions, an important growth segment.

Growth Rates Begin to Look Up for Atomic Spectroscopy

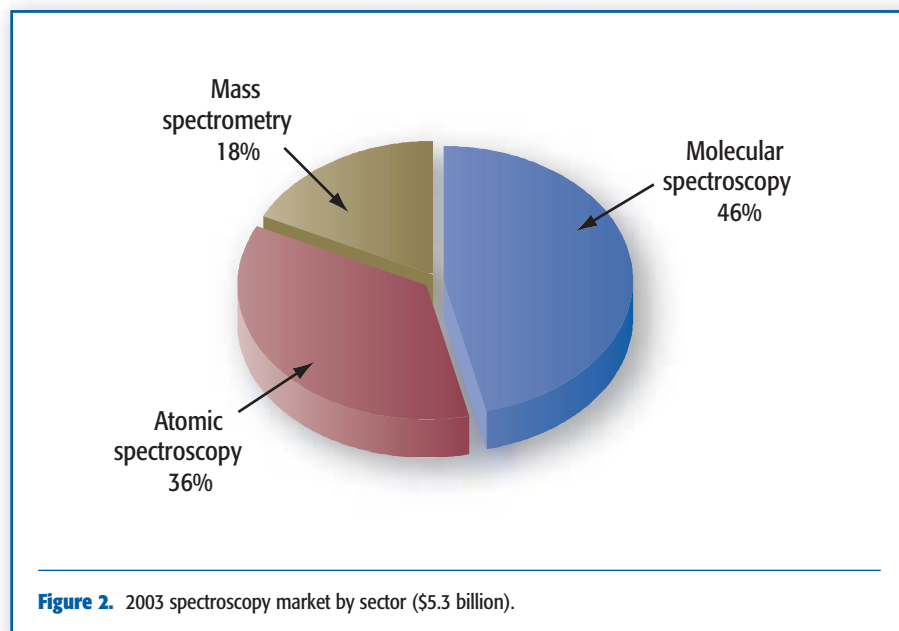
The atomic spectroscopy market fared reasonably well in 2003, and continued to



improve as compared to the last two years' performance. The semiconductor industry began to revive in 2003, but not nearly enough to make much of a difference to instrument vendors. Most observers expect solid improvement in 2004. The moribund metals industry, especially in the US and in Europe, still has not signaled intentions to increase capital investments, although major investments in Asia, particularly in China, represent the one sector where business is booming, including instrument sales. Asian purchases are generally up over 2002 for the full range of instrumental techniques, but especially for arc/spark, atomic absorption (AA), and elemental analyzers.

Prospects for atomic spectroscopy are beginning to brighten, and growth rates are expected to increase during the next few years. In 2003, the overall growth rate for atomic spectroscopy was 3.6%, about the same as 2002. However, the market should expand by about 4.7% this year, and perhaps grow 5.5% in 2005. These gains are due to a combination of factors. Among these are the generally improving economic conditions around the world, especially in Asia. Increased environmental concerns also are spurring investment for instrumentation for environmental monitoring and testing worldwide, in industrialized nations as well as in developing countries. The life sciences area, as well as food and beverage processing, also can be expected to offer increased opportunities for manufacturers of atomic spectroscopy instruments.

The x-ray category of instruments, x-ray diffraction (XRD) and x-ray fluorescence (XRF), represent about one-third of the worldwide market for atomic spectroscopy and they also are expected to exhibit good growth in 2004 and beyond. Both powder and single-crystal x-ray techniques should be in strong demand in 2004, although the single-crystal segment has slowed somewhat as a fall out from the slowdown in the pharmaceutical industry. Still, XRD is indispensable to proteomics research, and its continued importance is assured. Powder XRD, the larger segment, has broader industrial applications, including some in life sci-



ences, especially for pharmaceutical quality control. The market for XRF instruments is beginning to benefit from increased capital investments in the metals, petroleum, and semiconductor industries, which account for over 60% of worldwide applications.

Increasing semiconductor, pharmaceutical, and environmental applications will keep inductively coupled plasma (ICP)-MS and elemental analyzer demand growing at 6.7% and 4.7% respectively. Total organic carbon (TOC) and mercury analyzers will outpace all other elemental analyzer products because of the resurging semiconductor industry, continued growth in pharmaceutical and food processing, and demand for pure water and ultrapure water testing. The ICP market should approach 6% growth in 2004, driven by worldwide interest in drinking water quality.

Arc/spark optical emission spectroscopy currently is experiencing renewed growth and is expected to do particularly well in 2004 and 2005, especially in China and India. Growth of from 3.5% to 4% in 2004 is predicted. As the most mature technique, AA spectroscopy likely will see only minimal growth, less than 1.5%, with system sales declining slightly. Only aftermarket purchases of consumables and software and service offer any growth potential.

MS Meeting New Analytical Needs

As usual, MS continues as the growth engine for molecular spectroscopy. And if it were not for the declining sector MS market, MS would be growing overall at more than 10% per year. Even so, the market still is expected to turn in growth close to 9% for 2004. Although the important pharmaceutical and biotechnology industries have moderated their appetite for capital investment, including sophisticated instrumentation, mass spectroscopists cannot seem to resist buying the latest products with enhanced sensitivity. Sensing this, MS suppliers have introduced a host of new high-resolution mass spectrometers to meet the pent-up demand; the technical challenges facing many scientists are daunting and MS appears to offer near-term solutions.

Quadrupole-time-of-flight (Q-TOF) MS currently is catching a second wind and strong demand is expected for this technique in 2004. Growth should top 12% for a product technology that soon will account for 20% of the MS market. Q-TOF's now are available in a wide variety of configurations, all with improved capabilities, and some are available at more affordable prices. Q-TOF MS is well suited for applications such as structural analysis, thus competing with NMR and XRD techniques, metabolism studies, and protein-protein and protein-ligand interaction studies. The

technique's high sensitivity and mass resolution are ideal qualities for research and development laboratories.

New developments in high-resolution LC-MS systems, such as improved ion-trap designs and more flexible tandem configurations, helped this instrumen-

market withdrawals. Nevertheless, LC-TOF MS still should hold the title of fastest growing MS technique in 2004.

The market for matrix assisted laser desorption ionization time-of-flight (MALDI-TOF) MS is relatively saturated now, and suffers from competition

with the advent of improved software. The superlative sensitivity and mass resolution of these instruments is the envy of many scientists as a solution to their most difficult analytical challenges. Suppliers continue to focus on higher performance at high cost, so the current es-

SPECTROSCOPY IS CONSIDERED A MATURE MARKET DUE TO ITS UBIQUITOUS NATURE AND OVERALL AGE, YET EVEN THE MOST TRADITIONAL SEGMENTS CONTINUE TO AID SCIENTISTS WORLDWIDE.

tation category achieve renewed momentum in 2003. Growth in 2004 should exceed 9%, and because this segment accounts for almost one-half of the high-resolution MS market, that growth is quite significant. Drug discovery and protein research in pharmaceutical and contract research labs is the main driving force. Several new triple quadrupole instruments were introduced in 2003, which re-energized that segment, while LC-TOF MS saw a mixed bag of product introductions and

with LC-TOF and Q-TOF techniques. MALDI-TOF should experience growth in 2004 of about 6%, some of which will be associated with units sold as part of integrated proteomic systems.

Sales of Fourier-transform (FT) mass spectrometers were very robust in 2003, due in large part to the introduction of new tandem FT-MS instruments. Despite the high cost of such instruments, the marketplace seems eager to invest in a technology that has no equal, and which is becoming more user friendly

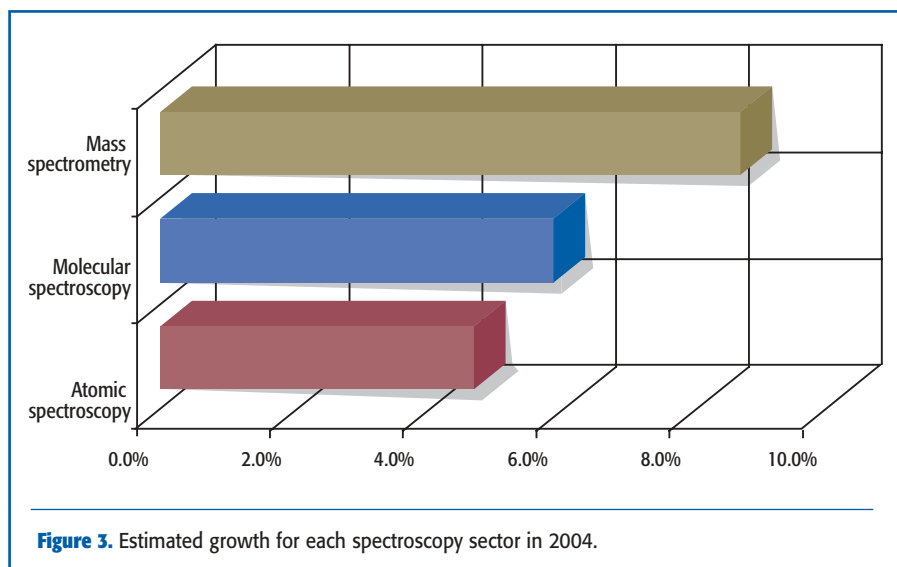
timated growth of 25% per year for FT-MS cannot hold up for long, except perhaps as replacements for aging magnetic sector instruments.

A Mainstay in the Modern Laboratory

Spectroscopy is considered a mature market due to its ubiquitous nature and overall age. Yet even the most traditional segments such as UV/Vis, AA, and XRD, continue to aid scientists worldwide in their efforts to discover

new treatments to prolong life, protect the environment, and enhance the performance of a host of products indispensable to daily life. Suppliers of these instrumental techniques have some dedication to the field and continue to develop new products with lower cost, enhanced performance, and innovative designs, especially products aimed at the life sciences marketplace. At the same time, genuine innovation permeates several product areas fairly new to the market, but which have great potential. Of course, this would include MS, Raman, and NMR.

Spectroscopy also is finding itself to be an important part of the overall trend in instrumental systems integration. So one can expect to see more and more combination (hyphenated) instruments being developed, especially as unique solutions to particular technical challenges where a simultaneous analysis is preferable to a sequential one. And one should not forget that many analytical technologies also re-



quire spectroscopic detection systems. So it is clear that spectroscopy, in its various forms, will continue to contribute to progress in many fields for years to come, although not subject to wild fluctuations in demand. There is something to be said about unabated steady growth. ■

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