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# Nanotechnology

## Introducing the Merrill Lynch Nanotech Index

**Reason for Report:** *New Index*

# Industry

### Highlights:

- We are introducing the Merrill Lynch Nanotech Index. It is an equally-weighted index of 25 companies that have a significant percentage of their future profits tied to nanotechnology.
- The Nanotech Index will be quoted intraday by the American Stock Exchange under the symbol “NNZ”. The historical time series back to 2002 should be available through data vendors.
- Our Nanotech Index is driven by quantitative construction and maintenance rules although subjective in which companies we determine to be primarily nanotech-driven. The constituents of the index will be updated twice a year and could expand as more pure plays become public. Note that the Index is not an investable product.
- We believe nanotechnology could be the next growth innovation following on the heels of information technology. Nanotechnology is the science of fabricating things smaller than 100 nanometers, at which point classical gives way to quantum physics. Like the Internet, nanotech may be overhyped short term, but we believe high barriers to entry and low barriers to adoption should make for a profitable sector longer term.

Merrill Lynch does and seeks to do business with companies covered in its research reports. As a result, investors should be aware that the firm may have a conflict of interest that could affect the objectivity of this report.

Investors should consider this report as only a single factor in making their investment decision.

Refer to important disclosures on page 4.

## Index Description

The Merrill Lynch Nanotech Index (NNZ) provides a diversified representation of nanotechnology stocks and ADRs traded in the United States. The majority of the components are involved in the following industries: semiconductors, biotechnology, instrumentation, sensors, diagnostics, drug delivery, drug development, genomics, and materials. The Merrill Lynch Nanotech Index is an equally-weighted index comprised of 25 nanotechnology stocks. The constituents of the index will be updated twice a year at Merrill Lynch's discretion.

## Here Comes Nanotechnology

We believe nanotechnology could be the next growth innovation, similar in importance to information technology over the past 50 years. Nanotech is the science of fabricating things smaller than 100 nanometers (a nanometer is one-billionth of a meter). Like the Internet, nanotech risks being overhyped. But unlike the Internet, there are intellectual property and patent barriers to entry but low barriers to adoption. Nanotech is real—the questions generally are when, not if. Nanotech is not a separate industry, but an approach applied to multiple disciplines (chemistry, biology, etc.).

We believe nanotechnology is the next logical step in miniaturization. At 100 nanometers classical gives way to quantum physics. Building at the nanoscale enables new interactions in materials, semiconductors, and biological agents. The new scale allows manipulation on the cellular level, which should enable new discoveries in pharmaceuticals, biodefense, and healthcare. The National Science Foundation (NSF) sees a potential market totaling \$1 trillion in the next 10-12 years as outlined in Table 1.

**Table 1: Potential Impact of Nanotechnology**

Sector	Size (\$B)	Share
Materials	\$340	31%
Electronics	300	28%
Pharmaceuticals	180	17%
Chemical Manufacture	100	9%
Aerospace	70	6%
Tools	20	2%
Improved Healthcare	30	3%
Sustainability	45	4%
Total	\$1,085	100%

Source: National Science Foundation

## Index Constituents

The Merrill Lynch Nanotech Index (NNZ) initially consists of the following companies that we believe have a significant portion of their future profits tied to nanotechnology (Table 2). Companies active in but not dependent on nanotech—such as IBM, GE, and 3M—are excluded.

**Table 2: Index Constituents (3/19/04)**

Company	Ticker	Speciality	Market Cap (\$M)
Amcol International	ACO	Materials	486
Applied Films	AFCO	Materials	470
Altair Nanotechnologies	ALTI	Materials	95
Biosante Pharmaceuticals	BPA	Nano Biotech	66
Caliper Life Sciences	CALP	Instrumentation	187
Cabot Corp*	CBT	Materials	2,071
Emcore	EMKR	Semiconductors	160
FEI	FEIC	Instrumentation	704
Flamel Technologies	FLML	Materials	477
Headwaters	HDWR	Energy	752
JMAR Tech	JMAR	Semiconductors	63
MTS Systems	MTSC	Instrumentation	554
Nanometrics	NANO	Instrumentation	187
Nanophase Technologies	NANX	Materials	143
Nanogen	NGEN	Nano Biotech	189
NVE Corp	NVEC	Intellectual Property	208
Universal Display	PANL	Imaging	287
Pharmacopeia	ACCL	Nano Biotech	472
SkyePharma	SKYE	Nano Biotech	739
Symyx Technologies	SMMX	Materials	881
Three-Five Systems	TFS	Imaging	125
Harris & Harris	TINY	Venture Capital	187
Ultratech	UTEK	Semiconductors	506
Veeco Instruments	VECO	Instrumentation	757
Westaim	WEDX	Venture Capital	175

Sources: ML TechStrat and Factset

\*Cabot Microelectronics (CCMP) was originally included in the Index in error.

## Index Close Since Inception

The following closing index values reflect the performance of the Index including Cabot Corp. (CBT rather than Cabot Microelectronics), since its inception.

**Table 3: Index Closing Value since Inception**

Date	NNZ
4/01/04	263.11
4/02/04	266.81
4/05/04	275.25
4/06/04	270.59
4/07/04	269.86
4/08/04	268.42

Source: ML TechStrat and Factset

Nanotech is in its emerging stage, so it's not surprising that many of the companies have small market caps. In terms of sector representation, materials, electronics, and biotech make up most of the index.

**Table 4: Index Sector Breakdown**

Sector	Companies	Percentage
Materials	7	28%
Instrumentation	5	20%
Biotech	4	16%
Semiconductors	3	12%
Imaging	2	8%
Venture Capital	2	8%
Energy	1	4%
Intellectual Property	1	4%
Total	25	100%

Sources: ML TechStrat and Factset

## Index Backcast

In Chart 1 we depict the simulated index levels using the straight backcasting method, which takes the current constituents and projects performance back in time. This approach provides the history of the current index. Although this method may inject look-ahead bias, the nanotech space is limited and the index includes almost all pure plays, so the bias should be small. We see that interest in the space and appreciation in nanotech stocks accelerated about one year ago.

**Chart 1: Nanotech Index (12/31/01-3/31/04)**



Sources: ML TechStrat and Factset

## Initial Index Construction

The Merrill Lynch Nanotech Index is constructed based on our review of company-supplied information regarding activities in nanotechnology. Nanotechnology is defined as working with components smaller than 100 nanometers. To be considered for the index, a company must have a significant percentage of its future profits tied to nanotechnology, and its stock must trade to a significant degree on its nanotech business. Therefore, companies such as GE and IBM, which have significant

nanotechnology efforts, are not included in the index.

The initial constituent shares are calculated as of March 19, 2004 as follows:

$$\text{Constituent Shares}_i = \frac{100,000}{P_i}$$

Where  $P_i$  is the primary exchange closing price of the  $i^{\text{th}}$  stock in the index as of the close March 19, 2004. The share figure is rounded to the nearest integer.

## Calculation of Index

The Nanotech Index is equally weighted and rebalanced semi-annually. The Index level is set to 250 as of December 31, 2001 and calculated using an equal dollar weighting methodology designed to ensure that each security is represented in an approximately equal dollar amount.

The American Stock Exchange (Amex) will act as the calculation agent for the Index. The Amex will on each business day: (1) calculate and cause to be disseminated over CTA Network B to market data vendors the value of the Index based on the most recent reported prices of the underlying stocks in the Index at approximately 15-second intervals during regular Amex business hours, and (2) calculate and cause to be disseminated over CTA Network B to market data vendors the closing value of the Index on such business day based on the closing prices of the underlying stocks in the Index. In addition, on each business day the Amex will make available to the public on request the current formula used by the Amex to calculate the Index.

The index divisor was initially determined to yield the benchmark value of 250.00 at the close of trading on December 31, 2001. Semi-annually thereafter, following the close of trading on the third Friday of March and September, the Merrill Lynch Nanotech Index portfolio is adjusted by changing the number of whole shares of each component stock so that each company is again represented in equal dollar amounts. The new shares are determined using the primary market closing prices of the second Friday of March and September, respectively. When necessary, a divisor adjustment will be made at the rebalancing/reconstitution to ensure the continuity of the index. The newly determined shares will then become the basis for the portfolio on the first trading day following the annual adjustment.

The number of shares of each component stock in the Nanotech Index remains fixed between rebalancings except in the event of certain corporate actions, such as the payment of a dividend other than ordinary cash, stock distribution, stock split, reverse stock split, rights offering, distribution, reorganization, recapitalization, or similar event with respect to the component stocks. Shares are not adjusted in the case of a share issuance or stock repurchase. The number of stocks in the index starts with 25 but may change at each rebalancing.

## Dissemination of Index

The value of the Merrill Lynch Nanotech Index is published every 15 seconds over the Consolidated Tape Association's Network B between the hours of approximately 9:30 a.m. and 4:15 p.m. (New York time) under the ticker "NNZ". The major electronic financial data vendors—Bloomberg, Quotron, Bridge Information Systems—republish information on the Index for their subscribers.

## Index Constituent Replacement

The index is calculated and maintained by the Amex in consultation with Merrill Lynch. Merrill Lynch may advise Amex regarding the handling of unusual corporate actions. Routine corporate actions (e.g., stock splits) that require straightforward index divisor adjustments are handled by the Exchange staff without consulting Merrill Lynch.

In the case of a merger or the consolidation of a component company, if the stock remains in the index the number of shares of that security in the portfolio may be adjusted to the nearest whole share to maintain the component's relative weight in the index at the level immediately prior to the corporate action. In the case of a spin-off, the spun company is not included in the index.

## Important Disclosures

### Investment Rating Distribution: Technology Group (as of 31 March 2004)

Coverage Universe	Count	Percent	Inv. Banking Relationships*	Count	Percent
Buy	109	47.60%	Buy	27	24.77%
Neutral	107	46.72%	Neutral	19	17.76%
Sell	13	5.68%	Sell	2	15.38%

### Investment Rating Distribution: Global Group (as of 31 March 2004)

Coverage Universe	Count	Percent	Inv. Banking Relationships*	Count	Percent
Buy	1085	44.03%	Buy	362	33.36%
Neutral	1215	49.31%	Neutral	306	25.19%
Sell	164	6.66%	Sell	28	17.07%

\* Companies in respect of which MLPF&S or an affiliate has received compensation for investment banking services within the past 12 months.

**OPINION KEY:** Opinions include a Volatility Risk Rating, an Investment Rating and an Income Rating. **VOLATILITY RISK RATINGS**, indicators of potential price fluctuation, are: A - Low, B - Medium, and C - High. **INVESTMENT RATINGS**, indicators of expected total return (price appreciation plus yield) within the 12-month period from the date of the initial rating, are: 1 - Buy (10% or more for Low and Medium Volatility Risk Securities - 20% or more for High Volatility Risk Securities); 2 - Neutral (0-10% for Low and Medium Volatility Risk securities - 0-20% for High Volatility Risk securities); 3 - Sell (negative return); and 6 - No Rating. **INCOME RATINGS**, indicators of potential cash dividends, are: 7 - same/higher (dividend considered to be secure); 8 - same/lower (dividend not considered to be secure); and 9 - pays no cash dividend.

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When possible, all stock replacements and unusual divisor adjustments caused by the occurrence of extraordinary events such as dissolution, merger, bankruptcy, non-routine spin-offs, or extraordinary dividends are made by the Exchange in consultation with Merrill Lynch. In the case of replacements, the largest non-index constituent in terms of market capitalization from the list of U.S.-traded technology stocks and ADRs will be chosen.

## Semi-Annual Index Rebalancing

Index reconstitution occurs semi-annually after the close of the third Friday of March and September. The reconstitution will take two steps: (1) determination of index constituents, and (2) share calculations to ensure equal weighting. Index constituents will be replaced if a stock is no longer deemed a representative nanotechnology name. The shares and volume figures are calculated using the data as of the second Friday of March and September.

Since the nanotech business is immature and new companies are likely to enter, Merrill Lynch may increase the number of stocks in the index when it deems necessary.