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Leedy

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(54) **THREE DIMENSIONAL STRUCTURE MEMORY**

(71) Applicant: **Glenn J Leedy**, Carmel, CA (US)

(72) Inventor: **Glenn J Leedy**, Carmel, CA (US)

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This patent is subject to a terminal disclaimer.

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(58) **Field of Classification Search**

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See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

2,915,722 A 12/1959 Foster
3,202,948 A 8/1965 Farrand

(Continued)

FOREIGN PATENT DOCUMENTS

DE 3233195 3/1983
EP 189976 8/1986

(Continued)

OTHER PUBLICATIONS

Bollmann et al., Three Dimensional Metallization for Vertically Integrated Circuits, MAM'97—Materials for Advanced Metallization.

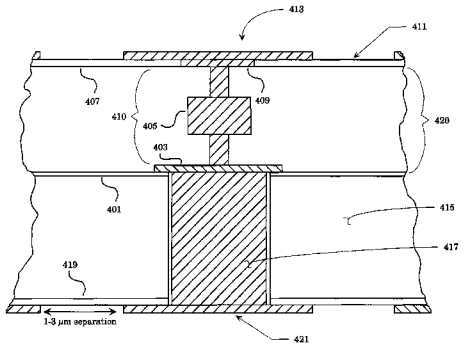
(Continued)

Primary Examiner — David Lam
(74) *Attorney, Agent, or Firm* — Useful Arts IP

(57) **ABSTRACT**

A Three-Dimensional Structure (3DS) Memory allows for physical separation of the memory circuits and the control logic circuit onto different layers such that each layer may be separately optimized. One control logic circuit suffices for several memory circuits, reducing cost. Fabrication of 3DS memory involves thinning of the memory circuit to less than 50 microns in thickness and bonding the circuit to a circuit stack while still in wafer substrate form. Fine-grain high density inter-layer vertical bus connections are used. The 3DS memory manufacturing method enables several performance and physical size efficiencies, and is implemented with established semiconductor processing techniques.

165 Claims, 9 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

3,430,835 A 3/1969 Patzer et al.
3,559,282 A 2/1971 Lesk
3,560,364 A 2/1971 Burkhardt
3,602,982 A 9/1971 Emmasingel
3,615,901 A 10/1971 Medicus
3,636,358 A 1/1972 Groschwitz
3,716,429 A 2/1973 Napoli et al.
3,777,227 A 12/1973 Krishna et al.
3,780,352 A 12/1973 Redwanz
3,868,565 A 2/1975 Kuipers
3,922,705 A 11/1975 Yerman
3,932,932 A 1/1976 Goodman
3,997,381 A 12/1976 Wanlass
4,028,547 A 6/1977 Eisenberger
4,070,230 A 1/1978 Stein
4,089,063 A 5/1978 Takezono et al.
4,104,418 A * 8/1978 Park et al. 427/567
4,131,985 A 1/1979 Greenwood et al.
4,142,004 A 2/1979 Hauser, Jr. et al.
4,196,232 A 4/1980 Schnable et al.
4,246,595 A 1/1981 Noyori et al.
4,249,302 A 2/1981 Crepeau
4,251,909 A 2/1981 Hoeberechts
4,262,631 A 4/1981 Kubacki
4,393,127 A 7/1983 Greschner et al.
4,394,401 A 7/1983 Shioya et al.
4,401,986 A 8/1983 Trenkler et al.
4,416,054 A 11/1983 Thomas et al.
4,464,747 A 8/1984 Groudan et al.
4,500,905 A 2/1985 Shibata
4,528,072 A 7/1985 Kurosawa et al.
4,539,068 A 9/1985 Takagi et al.
4,566,037 A 1/1986 Takatsu et al.
4,585,991 A 4/1986 Reid et al.
4,604,162 A 8/1986 Sobczak
4,612,083 A 9/1986 Yasumoto et al.
4,617,160 A 10/1986 Belanger et al.
4,618,397 A 10/1986 Shimizu et al.
4,618,763 A 10/1986 Schmitz
4,622,632 A 11/1986 Tanimoto et al.
4,633,438 A 12/1986 Kume et al.
4,637,029 A * 1/1987 Hayakawa et al. 372/45.01
4,642,487 A 2/1987 Carter
4,663,559 A 5/1987 Christensen
4,684,436 A 8/1987 Burns et al.
4,693,770 A 9/1987 Hatada
4,702,336 A 10/1987 Seibert et al.
4,702,936 A 10/1987 Maeda et al.
4,706,166 A 11/1987 Go
4,721,938 A 1/1988 Stevenson
4,724,328 A 2/1988 Lischke
4,761,681 A 8/1988 Reid
4,766,670 A 8/1988 Gazdik et al.
4,784,721 A 11/1988 Holmen et al.
4,810,673 A 3/1989 Freeman
4,810,889 A 3/1989 Yokomatsu et al.
4,825,277 A 4/1989 Mattox et al.
4,835,765 A 5/1989 Bergmans et al.
4,841,483 A 6/1989 Furuyama
4,849,857 A 7/1989 Butt et al.
4,855,867 A 8/1989 Gazdik et al.
4,857,481 A 8/1989 Tam et al.
4,890,157 A 12/1989 Wilson
4,892,753 A 1/1990 Wang et al.
4,892,842 A * 1/1990 Corrie et al. 438/59
4,897,708 A 1/1990 Clements
4,919,749 A 4/1990 Mauger et al.
4,924,589 A 5/1990 Leedy
4,928,058 A 5/1990 Williamson
2,641,129 A 6/1990 Bull
4,934,799 A 6/1990 Chu
4,939,568 A 7/1990 Kato et al.
4,939,694 A 7/1990 Eaton et al.
4,952,446 A 8/1990 Lee et al.
4,954,865 A 9/1990 Rokos
4,954,875 A 9/1990 Clements
4,957,882 A 9/1990 Shinomiya
4,965,415 A 10/1990 Young et al.
4,966,663 A 10/1990 Mauger
4,983,251 A 1/1991 Haisma et al.
4,988,423 A 1/1991 Yamamoto
4,990,462 A 2/1991 Sliwa
4,994,336 A 2/1991 Benecke et al.
4,994,735 A 2/1991 Leedy
5,000,113 A 3/1991 Wang et al.
5,008,619 A 4/1991 Keogh et al.
5,010,024 A 4/1991 Allen et al.
5,020,219 A 6/1991 Leedy
5,045,921 A 9/1991 Lin et al.
5,051,326 A 9/1991 Celler et al.
5,059,556 A 10/1991 Wilcoxen
5,062,689 A 11/1991 Koehler
5,064,275 A 11/1991 Tsunoda et al.
5,070,026 A 12/1991 Greenwald et al.
5,071,510 A 12/1991 Findler et al.
5,087,585 A 2/1992 Hayashi
5,098,865 A 3/1992 Machado et al.
5,103,557 A 4/1992 Leedy
5,109,360 A 4/1992 Inazumi et al.
5,110,373 A 5/1992 Mauger
5,110,712 A 5/1992 Kessler et al.
5,111,278 A 5/1992 Eichelberger
5,116,777 A 5/1992 Chan et al.
5,117,282 A 5/1992 Salatino
5,119,164 A 6/1992 Sliwa et al.
5,130,894 A 7/1992 Miller
5,132,244 A 7/1992 Roy
5,144,142 A 9/1992 Fueki et al.
5,151,775 A 9/1992 Hadwin
5,156,909 A 10/1992 Henager, Jr. et al.
5,166,962 A 11/1992 Murooka et al.
5,169,805 A 12/1992 Mok et al.
5,188,706 A 2/1993 Hori et al.
5,198,965 A 3/1993 Curtis et al.
5,202,754 A 4/1993 Bertin et al.
5,203,731 A 4/1993 Zimmerman
5,225,771 A 7/1993 Leedy
5,236,118 A 8/1993 Bower et al.
5,240,458 A 8/1993 Linglain et al.
5,241,454 A 8/1993 Ameen et al.
5,245,227 A 9/1993 Furtek et al.
5,245,277 A 9/1993 Nguyen
5,255,227 A 10/1993 Haeffele
5,259,247 A 11/1993 Bantien
5,262,341 A 11/1993 Fueki et al.
5,262,351 A 11/1993 Bureau et al.
5,270,261 A 12/1993 Bertin et al.
5,273,940 A 12/1993 Sanders
5,274,270 A 12/1993 Tuckerman
5,278,839 A 1/1994 Matsumoto et al.
5,279,865 A 1/1994 Chebi et al.
5,283,107 A 2/1994 Bayer et al.
5,284,796 A 2/1994 Nakanishi et al.
5,284,804 A 2/1994 Moslehi
5,293,457 A 3/1994 Arima et al.
5,321,884 A 6/1994 Ameen et al.
5,323,035 A 6/1994 Leedy
5,323,060 A 6/1994 Fogal et al.
5,324,687 A 6/1994 Wojnarowski
5,338,975 A * 8/1994 Cole et al. 257/750
5,343,366 A 8/1994 Cipolla et al.
5,343,406 A 8/1994 Freeman
5,347,428 A 9/1994 Carson et al.
5,354,695 A 10/1994 Leedy
5,357,473 A 10/1994 Mizuno et al.
5,358,909 A 10/1994 Hashiguchi et al.
5,363,021 A 11/1994 MacDonald
5,374,564 A 12/1994 Bruel
5,374,569 A 12/1994 Yilmaz et al.
5,374,920 A 12/1994 Evens

(56) **References Cited**

U.S. PATENT DOCUMENTS

5,385,909 A 1/1995 Nelson et al.
5,397,747 A 3/1995 Angiulli et al.
5,399,505 A 3/1995 Dasse et al.
RE34,893 E 4/1995 Fujii et al.
5,420,458 A 5/1995 Shimoji
5,424,920 A 6/1995 Miyake
5,426,072 A 6/1995 Finnila
5,426,363 A 6/1995 Akagi et al.
5,426,378 A 6/1995 Ong
5,432,444 A 7/1995 Yasohama et al.
5,432,681 A 7/1995 Linderman
5,432,719 A 7/1995 Freeman
5,432,729 A 7/1995 Carson et al.
5,432,999 A 7/1995 Capps et al.
5,434,500 A 7/1995 Hauck et al.
5,448,106 A 9/1995 Fujitsu
5,450,603 A 9/1995 Davies
5,451,489 A 9/1995 Leedy
5,457,879 A 10/1995 Gurtler et al.
5,463,246 A 10/1995 Matsunami
5,468,606 A 11/1995 Bogart et al.
5,470,693 A 11/1995 Sachdev et al.
5,476,813 A 12/1995 Naruse
5,478,781 A 12/1995 Bertin et al.
5,480,842 A 1/1996 Clifton et al.
5,481,133 A 1/1996 Hsu
5,489,554 A 2/1996 Gates
5,502,667 A 3/1996 Bertin et al.
5,512,397 A 4/1996 Leedy
5,514,628 A 5/1996 Enomoto et al.
5,517,457 A 5/1996 Sakui et al.
5,527,645 A 6/1996 Pati et al.
5,529,829 A 6/1996 Koskenmaki et al.
5,534,465 A 7/1996 Frye et al.
5,552,995 A 9/1996 Sebastian
5,555,212 A 9/1996 Toshiaki et al.
5,563,084 A 10/1996 Ramm et al.
5,571,741 A 11/1996 Leedy
5,572,689 A 11/1996 Gallup et al.
5,574,729 A 11/1996 Kinoshita et al.
5,577,050 A 11/1996 Bair et al.
5,580,687 A 12/1996 Leedy
5,581,498 A 12/1996 Ludwig et al.
5,582,939 A 12/1996 Pierrat
5,583,688 A 12/1996 Hornbeck
5,583,749 A 12/1996 Tredennick
5,592,007 A 1/1997 Leedy
5,592,018 A 1/1997 Leedy
5,595,933 A 1/1997 Heijboer
5,606,186 A 2/1997 Noda
5,615,163 A 3/1997 Sakui et al.
5,620,915 A 4/1997 Chen et al.
5,626,137 A 5/1997 Dumoulin et al.
5,627,112 A 5/1997 Tennant et al.
5,629,137 A 5/1997 Leedy
5,633,209 A 5/1997 Leedy
5,637,536 A 6/1997 Val
5,637,907 A 6/1997 Leedy
5,654,127 A 8/1997 Leedy
5,654,220 A 8/1997 Leedy
5,656,552 A 8/1997 Hudak et al.
5,661,339 A 8/1997 Clayton
5,666,288 A 9/1997 Jones et al.
5,675,185 A 10/1997 Chen et al.
5,691,945 A 11/1997 Liou et al.
5,694,588 A 12/1997 Ohara et al.
5,703,747 A 12/1997 Voldman et al.
5,715,144 A 2/1998 Ameen et al.
5,719,438 A 2/1998 Beilstein, Jr. et al.
5,725,995 A 3/1998 Leedy
5,733,814 A 3/1998 Flesher et al.
5,736,448 A 4/1998 Saia et al.
5,745,076 A 4/1998 Turlington et al.
5,753,536 A 5/1998 Sugiyama et al.
5,760,478 A 6/1998 Bozso et al.
5,763,943 A 6/1998 Baker et al.
5,764,577 A 6/1998 Johnston et al.
5,764,878 A 6/1998 Kablanian et al.
5,773,152 A 6/1998 Okonogi
5,777,379 A 7/1998 Karavakis et al.
5,786,116 A 7/1998 Rolfson
5,786,628 A 7/1998 Beilstein, Jr. et al.
5,786,629 A 7/1998 Faris
5,787,445 A 7/1998 Daberko
5,793,115 A 8/1998 Zavracky et al.
5,818,748 A 10/1998 Bertin et al.
5,831,280 A 11/1998 Ray
5,834,162 A 11/1998 Malba
5,834,334 A 11/1998 Leedy
5,840,593 A 11/1998 Leedy
5,847,929 A 12/1998 Bernier et al.
5,856,695 A 1/1999 Ito et al.
5,861,761 A 1/1999 Kean
5,868,949 A 2/1999 Sotokawa et al.
5,869,354 A 2/1999 Leedy
5,870,176 A 2/1999 Sweatt et al.
5,880,010 A 3/1999 Davidson
5,882,532 A 3/1999 Field et al.
5,892,271 A 4/1999 Takeda et al.
5,902,118 A 5/1999 Hubner
5,907,178 A 5/1999 Baker et al.
5,907,248 A 5/1999 Bauer
5,914,504 A 6/1999 Augusto
5,915,167 A 6/1999 Leedy
5,930,150 A 7/1999 Cohen et al.
5,940,031 A 8/1999 Turlington et al.
5,946,559 A 8/1999 Leedy
5,976,953 A 11/1999 Zavracky et al.
5,985,693 A 11/1999 Leedy
5,998,069 A 12/1999 Cutter et al.
6,002,268 A 12/1999 Sasaki
6,008,126 A 12/1999 Leedy
6,008,530 A 12/1999 Kano
6,017,658 A 1/2000 Rhee et al.
6,020,257 A 2/2000 Leedy
6,023,098 A 2/2000 Higshiguchi et al.
6,027,958 A 2/2000 Vu et al.
RE36,623 E 3/2000 Wang et al.
6,045,625 A 4/2000 Houston
6,050,832 A 4/2000 Lee et al.
6,084,284 A 7/2000 Adamic, Jr.
6,087,284 A 7/2000 Brix et al.
6,092,174 A 7/2000 Roussakov
6,097,096 A 8/2000 Gardner et al.
6,133,626 A 10/2000 Hawke et al.
6,133,640 A 10/2000 Leedy
6,154,809 A 11/2000 Ikenaga et al.
6,166,559 A 12/2000 McClintock
6,166,711 A 12/2000 Odake
6,194,245 B1 2/2001 Tayanaka
6,197,456 B1 3/2001 Aleshin et al.
6,208,545 B1 3/2001 Leedy
6,230,233 B1 5/2001 Lofgren et al.
6,236,602 B1 5/2001 Patti
6,239,495 B1 5/2001 Sakui et al.
6,261,728 B1 7/2001 Lin
6,288,561 B1 9/2001 Leedy
6,294,909 B1 9/2001 Leedy
6,300,935 B1 10/2001 Sobel et al.
6,301,653 B1 10/2001 Mohamed et al.
6,320,593 B1 11/2001 Sobel et al.
6,335,491 B1 1/2002 Alagaratnam et al.
6,355,976 B1 3/2002 Faris
RE37,637 E 4/2002 Clifton et al.
6,376,909 B1 4/2002 Forbes et al.
6,392,304 B1 5/2002 Butler
6,417,027 B1 7/2002 Akram
6,437,990 B1 8/2002 Degani et al.
6,445,006 B1 9/2002 Brandes et al.
6,511,857 B1 1/2003 Kono et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

6,551,857	B2	4/2003	Leedy	
6,563,224	B2	5/2003	Leedy	
6,617,671	B1	9/2003	Akram	
6,632,706	B1	10/2003	Leedy	
6,682,981	B2	1/2004	Leedy	
6,707,160	B2	3/2004	Yamaji	
6,713,327	B2	3/2004	Leedy	
6,714,625	B1	3/2004	Leedy	
6,734,539	B2	5/2004	Degani et al.	
6,740,964	B2	5/2004	Sasaki	
6,747,347	B2	6/2004	Farrar et al.	
6,765,279	B2	7/2004	Leedy	
6,838,896	B2	1/2005	Leedy	
6,867,486	B2	3/2005	Hong	
6,873,057	B2	3/2005	Chen et al.	
6,891,387	B2	5/2005	Leedy	
6,894,392	B1	5/2005	Gudesen et al.	
6,979,895	B2	12/2005	Akram et al.	
7,106,646	B2	9/2006	Schoenfeld et al.	
7,138,295	B2	11/2006	Leedy	
7,176,545	B2	2/2007	Leedy	
7,176,579	B2	2/2007	Konishi et al.	
7,193,239	B2	3/2007	Leedy	
7,223,696	B2	5/2007	Leedy	
7,230,316	B2	6/2007	Yamazaki et al.	
7,242,012	B2	7/2007	Leedy	
7,307,020	B2	12/2007	Leedy	
7,354,798	B2	4/2008	Pogge et al.	
7,385,835	B2	6/2008	Leedy	
7,402,897	B2	7/2008	Leedy	
7,474,004	B2	1/2009	Leedy	
7,479,694	B2	1/2009	Leedy	
7,485,571	B2	2/2009	Leedy	
7,485,955	B2	2/2009	Kang et al.	
7,489,025	B2	2/2009	Chen et al.	
7,504,732	B2	3/2009	Leedy	
7,521,785	B2	4/2009	Damberg et al.	
7,550,805	B2	6/2009	Leedy	
7,615,837	B2	11/2009	Leedy	
7,670,893	B2	3/2010	Leedy	
7,705,466	B2	4/2010	Leedy	
7,736,948	B2	6/2010	Dekker et al.	
7,763,948	B2	7/2010	Leedy	
7,820,469	B2	10/2010	Leedy	
7,911,012	B2	3/2011	Leedy	
8,080,442	B2	12/2011	Leedy	
8,410,617	B2 *	4/2013	Leedy	257/777
2001/0002711	A1	6/2001	Gonzalez	
2001/0013423	A1	8/2001	Dalal et al.	
2001/0014051	A1	8/2001	Watanabe et al.	
2001/0025364	A1	9/2001	Kaneko	
2001/0033030	A1	10/2001	Leedy	
2002/0117689	A1	8/2002	Akimoto	
2002/0127775	A1	9/2002	Haba et al.	
2002/0132465	A1	9/2002	Leedy	
2003/0011032	A1	1/2003	Umebayashi	
2003/0173608	A1	9/2003	Leedy	
2003/0184976	A1	10/2003	Brandenburg et al.	
2003/0197253	A1	10/2003	Gann et al.	
2003/0218182	A1	11/2003	Leedy	
2003/0223535	A1	12/2003	Leedy	
2004/0000708	A1	1/2004	Rapport et al.	
2004/0021212	A1	2/2004	Hamaguchi et al.	
2004/0070063	A1	4/2004	Leedy	
2004/0140547	A1	7/2004	Yamazaki et al.	
2004/0197951	A1	10/2004	Leedy	
2004/0245617	A1	12/2004	Damberg et al.	
2004/0251557	A1	12/2004	Kee	
2005/0023656	A1	2/2005	Leedy	
2005/0051841	A1	3/2005	Leedy	
2005/0051904	A1	3/2005	Kim et al.	
2005/0082641	A1	4/2005	Leedy	
2006/0231927	A1	10/2006	Ohno	
2008/0237591	A1	10/2008	Leedy	
2008/0254572	A1	10/2008	Leedy	
2008/0284611	A1	11/2008	Leedy	
2008/0302559	A1	12/2008	Leedy	
2009/0014897	A1	1/2009	Ohno	
2009/0067210	A1	3/2009	Leedy	
2009/0174082	A1	7/2009	Leedy	
2009/0175104	A1	7/2009	Leedy	
2009/0194768	A1	8/2009	Leedy	
2009/0218700	A1	9/2009	Leedy	
2009/0219742	A1	9/2009	Leedy	
2009/0219743	A1	9/2009	Leedy	
2009/0219744	A1	9/2009	Leedy	
2009/0219772	A1	9/2009	Leedy	
2009/0230501	A1	9/2009	Leedy	
2010/0148371	A1	6/2010	Kaskoun et al.	
2010/0171224	A1	7/2010	Leedy	
2010/0171225	A1	7/2010	Leedy	
2010/0172197	A1	7/2010	Leedy	
2010/0173453	A1	7/2010	Leedy	
2011/0042829	A1	2/2011	Kaskoun et al.	
2011/0198672	A1	8/2011	Leedy	

FOREIGN PATENT DOCUMENTS

EP	201380	12/1986
EP	224418	6/1987
EP	238089	9/1987
EP	314437	5/1989
EP	419898	4/1991
EP	455455	11/1991
EP	487302	5/1992
EP	503816	9/1992
EP	0 518 283	12/1992
EP	0 518 774	12/1992
EP	518283	12/1992
EP	518774	12/1992
EP	526551	2/1993
EP	0531723	3/1993
EP	0 554 063	8/1993
EP	0 555 252	8/1993
EP	554063	8/1993
EP	555252	8/1993
EP	703618	3/1996
EP	703619	3/1996
EP	731525	9/1996
EP	1233444	12/2002
FR	2641129	6/1990
GB	2125168	2/1984
GB	2215168	9/1989
JP	6074643	4/1985
JP	60126871	7/1985
JP	6130059	2/1986
JP	62277556	11/1987
JP	63076484	4/1988
JP	1199476	9/1988
JP	63229862	9/1988
JP	1157561	6/1989
JP	H01-199476	8/1989
JP	2027600	1/1990
JP	2037655	2/1990
JP	2082564	3/1990
JP	2239627	9/1990
JP	3127816	5/1991
JP	3174715	7/1991
JP	3284871	12/1991
JP	4010649	1/1992
JP	4042957	2/1992
JP	4076946	3/1992
JP	4083371	3/1992
JP	4107964	4/1992
JP	456956	12/1992
JP	5109977	4/1993
JP	05-250900	9/1993
JP	5283607	10/1993
JP	06-251172	9/1994
JP	06-291250	10/1994

(56) **References Cited**

FOREIGN PATENT DOCUMENTS

JP	08-083884	3/1996
JP	08-504060	4/1996
JP	4196263	7/1996
JP	9152979	6/1997
JP	10107065	4/1998
JP	10209371	8/1998
JP	261001	9/1999
WO	8910255	11/1989
WO	9009093	8/1990
WO	9105366	4/1991
WO	9203848	3/1992
WO	9217901	10/1992
WO	9413121	6/1994
WO	9509438	4/1995
WO	9641204	12/1996
WO	9641264	12/1996
WO	9641624	12/1996
WO	9819337	5/1998
WO	0105366	1/2001
WO	03078305	9/2003

OTHER PUBLICATIONS

"Christensens Physics of Diagnostic Radiology," Currey et al., pp. 29-33, 1990.

"IC Tower Patent: Simple Technology Receives Patent on the IC Tower, a Stacked Memory Technology", http://ww-w.simpletech.com/whatsnew/memory/@60824.htm (1998).

"Miniature Electro Microscopes Without Vacuum Pumps, Self-Contained Microfabricated Devices with Short Working Distances, Enable Operation in Air," NASA Tech Briefs, 39-40 (1998).

"Partitioning Function and Packaging of Integrated Circuits for Physical Security of Data," IBM Technical Disclosure Bulletin, IBM Corp., 32(1):46-49 (Jun. 1989).

Aboaf, J.A., "Stresses in SiO.sub.2 Films Obtained from the Thermal Decomposition of Tetraethylorthosilicate—Effect of Heat Treatment and Humidity," J. Electrochem. Soc.: Solid State Science; 116(12): 1732-1736 (Dec. 1969).

Allen, Mark G., and Senturia, Stephen D., "Measurement of Polyimide Interlayer Adhesion Using Microfabricated Structures"; Sep. 25-30, 1988.

Alloert, K., et al., "A Comparison Between Silicon Nitride Films Made by PCVD of N.sub.2-SiH.sub.4/Ar and N.sub.2-SiH.sub.4/He," Journal of the Electrochemical Society, vol. 132, No. 7, pp. 1763-1766, (Jul. 1985).

Bailey, R., "Glass for Solid-State Devices: Glass film has low intrinsic compressive stress for isolating active layers of magnetic-bubble and other solid-state devices," NASA Tech Brief (1982).

Boyer, P.K.; Collins, G.J.; Moore, C.A.; Ritchie, W.K.,; Roche, G. A.; Solanski, R. (A); Tang, C.C.; "Microelectronic thin film deposition by ultraviolet laser photolysis Monograph Title—Laser processing of semiconductor devices"; 1983; pp. 120-126.

Chang, E.Y.; Cibuzar, G.T.; Pande, K.P.; "Passivation of GaAs FETs with PECVD silicon nitride films of different stress states"; Sep. 1988; pp. 1412-1418.

Chen, Y.S.; Fatemi, H.; "Stress measurements on multilevel thin film dielectric layers used in Si integrated circuits"; May-Jun. 1986; pp. 645-649.

Chu et al., ed., 3D Packaging for Integrated Circuit Systems, Sandia Report SAND96-2801, UC-704, Nov. 1996.

Draper, B. L.; Hill, T.A.; "Stress and stress relaxation in integrated circuit metals and dielectrics"; Jul.-Aug. 1991; pp. 1956-1962.

European Search Report for Application No. EP 02 00 9643 (date completed: Oct. 8, 2002).

Garino, T.J.; Harrington, H. M.; "Residual stress in PZT thin films and its effect on ferroelectric properties"; 1992; pp. 341-347.

Guckel, H.; "Surface micromachined pressure transducers"; 1991; pp. 133-146.

Hayashi et al., A New Three Dimensional IC Fabrication Technology,

Hendricks et al., "Polyquinoline Coatings and Films: Improved Organic Dielectrics for ICs and MCMs," Eleventh IEEE/CHMT International Electronics Manufacturing Technology Symposium, pp. 361-365 (1991).

Hsieh, et al., "Directional Deposition of Dielectric Silicon Oxide by Plasma Enhanced TEOS Process," 1989 Proceedings, Sixth International IEEE VLSI Multilevel Interconnection Conference, pp. 411-415 (1989).

Jones, R.E., Jr. "An evaluation of methods for passivating silicon integrated circuits", Apr. 1972; pp. 23-28.

Knolle, W.R., et al., "Characterization of Oxygen-Doped, Plasma-Deposited Silicon Nitride," Journal of the Electrochemical Society, vol. 135, No. 5, pp. 1211-1217, (May 1988).

Kochugova, I.V.; Nikolaeva, L.V.; Vakser, N.M., (M.I. Kalinin Leningrad Polytechnic Institute (USSR); "Electrophysical investigation of thin-layered inorganic coatings"; 1989: pp. 826-828.

Koyanagi, Different Approaches to 3D Chips, Dept. of Bioengineering and Robotics, Tohoku University, Japan, pp. 10, 11, 13, 14, 16, 19.

Krishnamoorthy, et al., "3-D Integration of MQW Modulators Over Active Submicron CMOS Circuits: 375 Mb/s Transimpedance Receiver-Transmitter Circuit," IEEE Photonics Technology Letters, 2(11): 1288-1290 (Nov. 1991.

Maw, T.; Hopla, R.E.; "Properties of a photoimageable thin polyimide film"; Nov. 26-29, 1990; pp. 71-76.

Mitsumasa Koyanagi et al., "Design of 4-KBIT X 4-layer Optically Coupled Three-Dimensional Common Memory for Parallel Processor System," IEEE Journal of Solid-State Circuits, vol. 25. No. 1, Feb. 1, 1990.

Nguyen, S.V., Plasma Assisted Chemical Vapor Deposited Thin Films for Microelectronic Applications, J. Vac. Sci. Technol. vol. B4, No. 5, pp. 1159-1167, (Sep.-Oct. 1986).

Olmer, et al., "Intermetal Dielectric Deposition by Plasma Enhanced Chemical Vapor Deposition," Fifth IEEE/CHMT International Electronic Manufacturing Technology Symposium—Design-to-Manufacturing Transfer Cycle, pp. 98-99 (1998).

Pai, Pei-Lin; "Multilevel Interconnection Technologies—A Framework and Examples"; 1987; pp. 1871.

Partial European Search Report for Application No. EP 02009643 (Oct. 8, 2002).

Pei-Lin Pai; Chetty, A.; Roat, R.; Cox, N.; Chiu Ting; "Material characteristics of spin-on glasses for interlayer dielectric applications"; Nov. 1987, pp. 2829-2834.

Phys. Rev. B., Condens, Matter Mater. Phys. (USA), Physical Review B (Condensed Matter and Materials Physics), Mar. 15, 2003, APS through AIP, USA.

Reche, J.J. H.; "Control of thin film materials properties used in high density multichip interconnect"; Apr. 24-28, 1989; p. 494.

Riley, P.E.; Shelley, A.; "Characterization of a spin-applied dielectric for use in multilevel metallization": May 1988; pp. 1207-1210.

Runyan, W. R., "Deposition of Inorganic Thin Films", Semiconductor Integrated Circuit Processing Technology, p. 142 (1990).

S Wolf, Silicon Processing for the VLSI Era, 1990, Lattice Press, vol. 2, p. 191.

Salazar, M.; Wilkins, C.W., Jr.; Ryan, V.W.: Wang, T.T.; "Low stress films of cyclized polybutadiene dielectrics by vacuum annealing"; Oct. 21-22, 1986; pp. 96-102.

Scheuerman, R.J., "Fabrication of Thin Dielectric Films with Low Internal Stresses," J. Vac. Sci. and Tech., 7(1): 143-146 (1970).

Smith et al., Generation of Minimal Vertex Covers for Row/Column Allocation in Self-Repairable Arrays, IEEE Transactions on Computers, vol. 45, No. 1, Jan. 1996, pp. 109-115.

Sun, R.C.; Tisone, T.C.: Cruzan, P.D.; "Internal stresses and resistivity of low-voltage sputtered tungsten films (microelectronic cct. conductor)"; Mar. 1973; pp. 1009-1016.

Sung et al., "Well-aligned carbon nitride nanotubes synthesized in anodic alumina by electron cyclotron resonance chemical vapor deposition," Applied Physics Letters, vol. 74, No. 2, 197, 1999, Jan. 11, 1999.

Svechnikov, S.V.; Kobylyatskaya, M.F.: Kimarskii, V.I.; Kaufman, A.P.; Kuzolvlev, Yu.I.; Cherepov, Ye. I.; Fomin, B.I.; "A switching plate with aluminum membrane crossings of conductors"; 1972.

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