Nanotechnology R&D Profiles: Carnegie Mellon University & University of Pittsburgh Nano Research Profile

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Background

This is a profile of nano research articles by Carnegie Mellon University & University of Pittsburgh researchers. It derives from nanoscience & nanoengineering datasets. We have prepared a separate, companion profile on nano patents by the two universities.

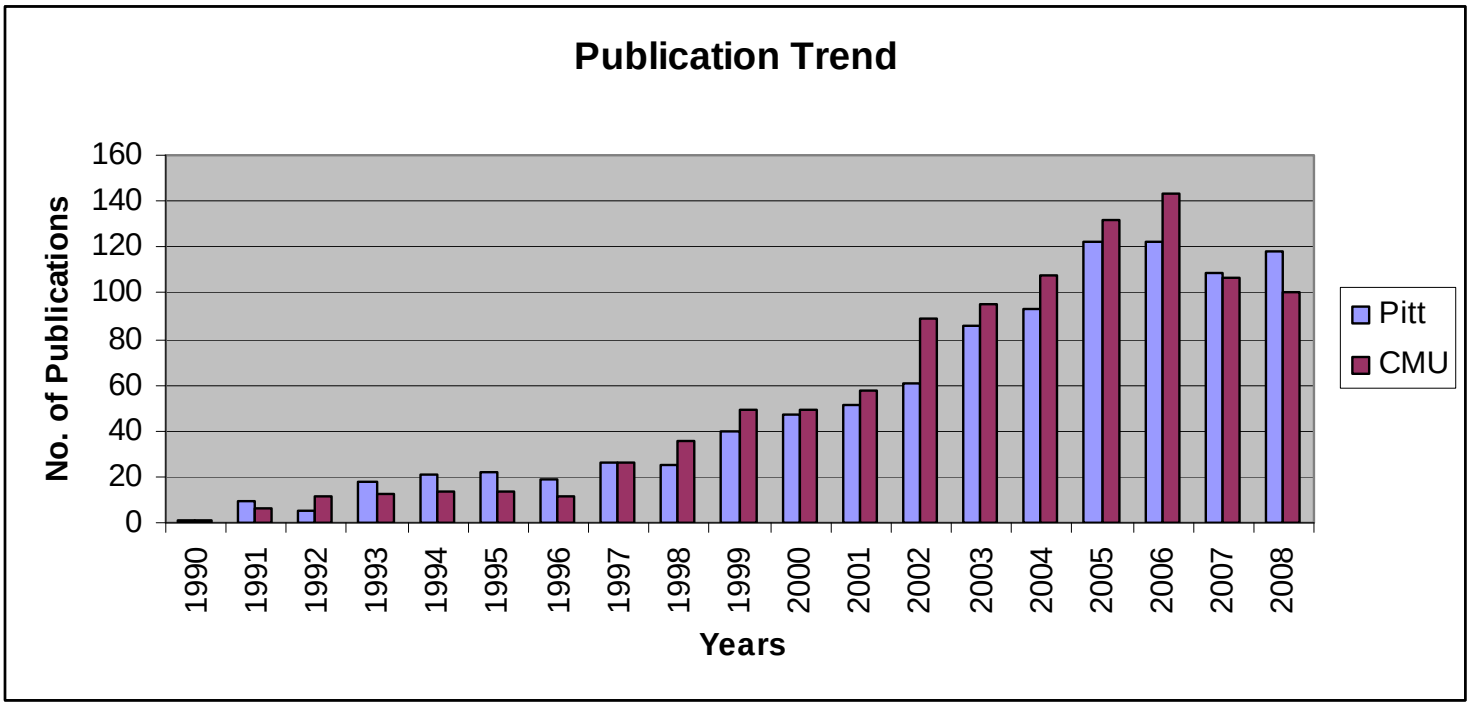
The information presented in this profile is based on a search of publication abstract records (Science Citation Index – "**SCI**" -- available through Web of Science).[1] These records are cleaned and analyzed using VantagePoint textmining software.[2] In this document, nanotechnology is abbreviated as "**nano**." Details of the modular Boolean nano search strategy for developing the dataset are contained in Porter et al.[3]

Over the past year, Georgia Tech has prepared several organizational nano research profiles. These are in support of industry-university workshops organized by the Center for Innovation Management Systems (CIMS) at North Carolina State University. We have also profiled Purdue, NASA-Langley, and the Tri-university nano consortium (Northeastern, Univ. of New Hampshire, Univ. of Massachusetts-Lowell). We are concurrently profiling Penn State University also.

Results

Figure 1 shows the number of publications over time by CMU & University of Pittsburgh researchers, as indexed in SCI.

Figure 1: Publication Trend



Note: Data for 2008 are normalized estimated

[1] www.isiknowledge.com/
[2] http://www.thevantagepoint.com/
[3] More information on the search strategy on which the information presented herein is based can be found in Porter, A.L., Youtie, J., Shapira, P., and Schoeneck, D.J., Refining Search Terms for Nanotechnology, Journal of Nanoparticle Research (First Online, 2007).

SCI categorizes journals into Subject Categories (about 175 of these; the number evolves slowly over time). These offer a quick sense of which fields are engaged in a given body of research activity. The diversity of capabilities that CMU and Pitt bring to bear on nano is notable!

Table 1: Top Subject Categories (10 or more articles in journals associated with these)

# Records	Subject Category (CMU)
280	Physics, Applied
194	Materials Science, Multidisciplinary
141	Chemistry, Multidisciplinary
128	Chemistry, Physical
104	Engineering, Electrical & Electronic
98	Polymer Science
84	Physics, Condensed Matter
30	Metallurgy & Metallurgical Engineering
23	Biochemistry & Molecular Biology
23	Electrochemistry
23	Nanoscience & Nanotechnology
21	Engineering, Mechanical
20	Physics, Multidisciplinary
18	Physics, Atomic, Molecular & Chemical
16	Environmental Sciences
15	Engineering, Biomedical
14	Crystallography
14	Materials Science, Coatings & Films
13	Materials Science, Biomaterials
13	Mechanics
13	Multidisciplinary Sciences
12	Engineering, Chemical
11	Biotechnology & Applied Microbiology
11	Engineering, Environmental

# Records	Subject Category (Pitt)
191	Chemistry, Physical
138	Chemistry, Multidisciplinary
115	Materials Science, Multidisciplinary
100	Physics, Applied
71	Physics, Condensed Matter
62	Physics, Atomic, Molecular & Chemical
47	Biochemistry & Molecular Biology
37	Polymer Science
34	Nanoscience & Nanotechnology
29	Cell Biology
26	Engineering, Biomedical
23	Physics, Multidisciplinary
22	Biotechnology & Applied Microbiology
22	Multidisciplinary Sciences
21	Chemistry, Analytical
20	Metallurgy & Metallurgical Engineering
19	Biophysics
16	Engineering, Chemical
16	Materials Science, Biomaterials
14	Materials Science, Coatings & Films
13	Pharmacology & Pharmacy
12	Biochemical Research Methods
12	Surgery
11	Chemistry, Organic
11	Engineering, Electrical & Electronic
11	Genetics & Heredity
11	Neurosciences
11	Oncology
10	Immunology
10	Medicine, Research & Experimental
10	Optics

Table 2 lists the most prevalent industrial collaborators who have co-authored nano papers with Carnegie Mellon & University of Pittsburgh researchers.

Table 2: Industry Collaboration

# Records	Affiliation (CMU)	# Records	Affiliation (Pitt)
13	Xerox Corp	9	Bell Labs
9	IBM Corp	7	NASA
7	NASA	6	IBM CORP
1	Dupont Co	4	Lucent Technol
1	Motorola Inc	1	Air Prod & Chem Inc
1	Procter & Gamble Co	1	DIGITAL INSTRUMENTS

Table 3 tallies the researchers with the most articles appearing. NOTE: By no means could this capture all Carnegie Mellon University & University of Pittsburgh nano-related research! Our nano search, while broad, will not retrieve every nano-related article. SCI focuses on fundamental science articles; its coverage of chemistry, engineering, medicine, and other domains is not as complete. Furthermore, note that SCI includes very few conference proceeding papers, nor book chapters, and so forth. In addition, while we clean and consolidate data, name variations and other formatting issues impeded retrieval of all publications.

Table 3: Top Authors

# Records	Authors (CMU)	# Records	Authors (Pitt)
117	Matyjaszewski, K	100	YATES, J T
88	Laughlin, D E	69	BALAZS, A C
77	Jhon, M S	52	Johnson, J K
69	McHenry, M E	38	WALDECK, D H
66	Kowalewski, T	38	Walker, G C
59	Majetich, S A	28	Levy, J
49	Choi, H J	27	ASHER, S A
45	Feenstra, R M	26	Mao, S X
41	Kumta, P N	26	Yang, J C
38	Sholl, D S	25	Snoke, D W
37	McCullough, R D	24	CHOYKE, W J
34	Skowronski, M	23	Borguet, E
29	Tilton, R D	17	Akhremitchev, B B
24	Sheiko, S S	17	JORDAN, K D
23	Lowry, G V	18	Lee, J
23	Zhu, J G	16	Barnard, J A
22	Greve, D W	14	Bemis, J E
20	Dufour, B	14	HAMILTON, A D
20	Lim, S T	14	Kim, H K
20	Towe, E	14	Liu, H Y
19	Bain, J A	12	GEIB, S J
18	Gellman, A J	12	Wiezorek, J M K

18	Northrup, J E	12	Zhou, G W
17	Rohrer, G S	11	Ahner, J
16	De Graef, M	11	Lee, J Y
15	Huang, M Q	11	Maksymovych, P
14	Lambeth, D N	11	West, K
14	Neugebauer, J	10	Castranova, V
14	Sitti, M	10	Coalson, R D
14	Tang, C B	10	Dougherty, D B
14	Walker, L M	10	Gilbert, S P
13	Harris, V G	10	Ginzburg, V V
13	LeDuc, P R	10	Kondratyuk, P
13	Pyun, J	10	Kuznetsova, A
13	Shukla, N	10	Petek, H
13	Willard, M A	10	Pfeiffer, L
12	Barmak, K	10	Singh, C
12	Chen, H J	10	Snoke, D
12	Kim, J W	10	Stolz, D B
12	Nuhfer, N T		
12	Smith, A R		
12	Tsarevsky, N V		
12	Zhang, R		
11	Jia, S J		
11	Lee, C H		
11	Peng, Y G		
11	Porter, L M		
11	Salvador, P A		
10	Amon, C H		
10	Cho, M S		
10	Chu, S Y		
10	Guo, Q		
10	Klemmer, T J		
10	Kruk, M		
10	Liu, C		
10	Mahajan, S		
10	Roy, A G		

To overcome the limitations of SCI's Keywords , we have created a new field. We merged the following fields in *VantagePoint*:

- Keywords (author) and Keywords (Plus) (from SCI)
- Title Phrases (parsed by *VantagePoint* using natural language processing) (from all three database sources)

The resulting key terms are shown in Table 4. We have screened these to remove less interesting, general terms. These give another perspective on the content emphases of Penn State nano research.

Table 4: Top Key Terms

#	Key Terms (CMU)	#	Key Terms (Pitt)
75	synthesis	108	SURFACES
68	surfaces	98	adsorption
65	FILMS	45	SCANNING-TUNNELING-MICROSCOPY
61	block-copolymers	44	THIN-FILMS
58	polymers	43	transport
58	TRANSFER RADICAL POLYMERIZATION	42	self-assembled monolayers
52	atom transfer radical polymerization	35	carbon nanotubes
51	THIN-FILMS	35	films
47	magnetic properties	34	interfaces
41	adsorption	33	ATOMIC-FORCE MICROSCOPY
40	nanocomposites	33	chemisorption
39	characterization	31	diblock copolymers
36	MOLECULAR-BEAM EPITAXY	26	proteins
34	interfaces	26	simulation
34	self-assembly	24	silicon
32	atomic force microscopy	23	expression
30	nanocrystals	23	MOLECULAR-DYNAMICS
30	silica	23	POLYMERS
27	SUSPENSIONS	22	excitons
27	microstructure	22	nanocomposites
26	simulation	22	self-assembly
25	carbon nanotubes	21	kinetics
25	polyaniline	19	copper
24	crystallization	19	coupled quantum wells
23	SCANNING-TUNNELING-MICROSCOPY	19	microstructure
21	ALLOYS	19	MONOLAYERS
21	TRANSITION	18	GOLD
21	oxidation	18	water
19	rheology	17	CO

Table 5 (A & B) summarizes an analysis of Key Terms by Year of publication. It orders these research topics in terms of which show the highest proportion of research in the past 2.5 years (recall that most of the data searching only covers through about 5 months of 2008). The "New/Old" ratio compares this most recent ~2.5 years vs. the prior 15 years. So, high ratios really indicate acceleration of activity on these research topics.

Table 5(A): "Hot" Carnegie Mellon University Nano Research Topical Areas

#	Key Terms	1990-2005	2006-2008	Ratio
75	synthesis	60	15	0.25
63	FILMS	37	26	0.70
58	TRANSFER RADICAL POLYMERIZATION	33	25	0.76
53	growth	37	16	0.43
50	nanoparticles	28	22	0.79
40	PARTICLES	28	12	0.43
40	adsorption	30	10	0.33
39	polymers	23	16	0.70
39	THIN-FILMS	25	14	0.56
35	surfaces	22	13	0.59
33	characterization	24	9	0.38
33	DYNAMICS	20	13	0.65
32	block-copolymers	14	18	1.29
31	Effect	22	9	0.41
30	self-assembly	24	6	0.25
26	structure	21	5	0.24
26	kinetics	16	10	0.63
26	ATRP	12	14	1.17
25	polyaniline	24	1	0.04
25	BEHAVIOR	21	4	0.19
24	SUSPENSIONS	23	1	0.04
24	microstructure	19	5	0.26
23	atom transfer radical polymerization	14	9	0.64
23	magnetic properties	20	3	0.15
23	MAGNETIC-PROPERTIES	15	8	0.53
22	nanocomposites	19	3	0.16
22	carbon nanotubes	14	8	0.57
22	MODEL	16	6	0.38
22	MOLECULAR-BEAM EPITAXY	19	3	0.16
21	microscopy	17	4	0.24
21	block copolymers	13	8	0.62
20	silica	16	4	0.25
19	rheology	15	4	0.27
19	ALLOYS	18	1	0.06
19	DEPENDENCE	9	10	1.11
19	TEMPERATURE	12	7	0.58
19	nanocrystals	13	6	0.46
18	preparation	14	4	0.29
18	FLUIDS	17	1	0.06
18	MORPHOLOGY	11	7	0.64

Table 5(B): "Hot" University of Pittsburgh Nano Research Topical Areas

#	Key Terms	1990-2005	2006-2008	Ratio
98	adsorption	71	27	0.38
52	SURFACES	33	19	0.58
45	NANOPARTICLES	27	18	0.67
43	oxidation	37	6	0.16
42	SPECTROSCOPY	27	15	0.56
38	DYNAMICS	20	18	0.90
38	self-assembled monolayers	29	9	0.31
37	THIN-FILMS	26	11	0.42
35	films	32	3	0.09
34	growth	25	9	0.36
33	carbon nanotubes	22	11	0.50
32	SCANNING-TUNNELING-MICROSCOPY	23	9	0.39
28	morphology	20	8	0.40
28	MODEL	22	6	0.27
26	transport	21	5	0.24
25	oxygen	21	4	0.19
24	silicon	19	5	0.26
23	expression	16	7	0.44
22	MOLECULES	13	9	0.69
22	MOLECULAR-DYNAMICS	16	6	0.38
21	MIXTURES	14	7	0.50
21	kinetics	17	4	0.24
20	METALS	12	8	0.67
20	nanocomposites	18	2	0.11
19	self-assembly	17	2	0.12
19	IN-VITRO	8	11	1.38
18	SYSTEMS	14	4	0.29
18	chemisorption	10	8	0.80
18	copper	15	3	0.20
18	water	13	5	0.38
18	ATOMIC-FORCE MICROSCOPY	12	6	0.50
18	GOLD	16	2	0.13
17	graphite	16	1	0.06
16	DESORPTION	12	4	0.33
16	IN-VIVO	6	10	1.67
16	MONOLAYERS	11	5	0.45
15	proteins	8	7	0.88
15	characterization	12	3	0.25
15	fabrication	8	7	0.88
15	cells	9	6	0.67
15	ALLOYS	12	3	0.25
15	diffraction	11	4	0.36

The "Top Twenty" [plus workshop attendees for whom we found multiple publications in the dataset] are profiled in Table 6(A & B). Column 3 collects the "top 5" subject categories of the given researcher's publications. Column 4 collects term phrases from Keywords (Author + Plus) and titles most prominent in his/her publication abstract records. Column 5 shows the percentage of recent papers (published in 2005-07) divided by total publications. This is intended to help workshop participants identify possible common interests.

Table 6(A): Research Profiles of Select Top Carnegie Mellon University Nano Researchers

# Pubs	Authors	Subject Category	Key Terms	Publication Year
117	Matyjaszewski, K	Polymer Science [54] Chemistry, Multidisciplinary [43] Chemistry, Physical [14] Materials Science, Multidisciplinary [8] Biochemistry & Molecular Biology [4]	TRANSFER RADICAL POLYMERIZATION [52] synthesis [30] polymers [28] block-copolymers [26] ATRP [25]	40% of 117
88	Laughlin, D E	Physics, Applied [73] Engineering, Electrical & Electronic [23] Materials Science, Multidisciplinary [15] Metallurgy & Metallurgical Engineering [8] Physics, Condensed Matter [5]	MAGNETIC-PROPERTIES [13] magnetic properties [11] microstructure [10] THIN-FILMS [9] MEDIA [8]	16% of 88
77	Jhon, M S	Polymer Science [26] Physics, Applied [21] Materials Science, Multidisciplinary [17] Engineering, Electrical & Electronic [11] Chemistry, Multidisciplinary [8]	polyaniline [23] SUSPENSIONS [21] FLUIDS [16] synthesis [15] rheology [13] nanocomposite [13]	16% of 77
69	McHenry, M E	Physics, Applied [47] Materials Science, Multidisciplinary [18] Engineering, Electrical & Electronic [12] Metallurgy & Metallurgical Engineering [7] Physics, Condensed Matter [6]	magnetic properties [16] MAGNETIC-PROPERTIES [10] structure [10] ULTRAFINE GRAIN-STRUCTURE [6] ALLOYS [5] GRAIN-SIZE [5] synthesis [5] crystallization [5] nanocrystalline alloys [5] FE-ZR-B [5] FERROMAGNETS [5] CO [5] nanocrystals [5] microstructure [5]	17% of 69
66	Kowalewski, T	Chemistry, Multidisciplinary [35] Polymer Science [17] Chemistry, Physical [11]	synthesis [17] TRANSFER RADICAL POLYMERIZATION [16] block copolymers [12]	32% of 66

		Materials Science, Multidisciplinary [7] Nanoscience & Nanotechnology [3] Physics, Applied [3]	block-copolymers [12] atom transfer radical polymerization [10] polymers [10]	
59	Majetich, S A	Physics, Applied [29] Materials Science, Multidisciplinary [13] Physics, Condensed Matter [13] Engineering, Electrical & Electronic [9] Chemistry, Physical [6]	PARTICLES [15] nanoparticles [8] FePt nanoparticles [7] IRON NANOPARTICLES [7] coercivity [7]	19% of 59
49	Choi, H J	Polymer Science [25] Materials Science, Multidisciplinary [15] Chemistry, Multidisciplinary [8] Chemistry, Physical [4] Physics, Condensed Matter [3]	polyaniline [23] SUSPENSIONS [21] FLUIDS [16] synthesis [14] nanocomposite [13]	0% of 49
45	Feenstra, R M	Physics, Applied [27] Materials Science, Multidisciplinary [14] Engineering, Electrical & Electronic [12] Physics, Condensed Matter [5] Chemistry, Physical [3] Physics, Multidisciplinary [3]	MOLECULAR-BEAM EPITAXY [15] GaN [14] growth [13] microscopy [12] RECONSTRUCTIONS [9]	9% of 45
41	Kumta, P N	Materials Science, Multidisciplinary [23] Electrochemistry [16] Chemistry, Physical [7] Energy & Fuels [6] Physics, Condensed Matter [6]	POWDERS [12] synthesis [8] TiN [8] ELECTRODES [7] FILMS [7]	27% of 41
38	Sholl, D S	Chemistry, Physical [17] Chemistry, Multidisciplinary [7] Materials Science, Multidisciplinary [5] Physics, Atomic, Molecular & Chemical [5] Nanoscience & Nanotechnology [4]	ATOMISTIC SIMULATIONS [12] adsorption [12] carbon nanotubes [11] ZEOLITE MEMBRANES [11] MIXTURES [9] silicalite [9]	39% of 38
37	McCullough, R D	Chemistry, Multidisciplinary [21] Materials Science, Multidisciplinary [12] Polymer Science [9] Chemistry, Physical [6] Physics, Condensed Matter [5]	POLY(3-ALKYLTHIOPHENES [12] conjugated polymers [10] self-assembly [7] conducting polymers [6] FILMS [5]	19% of 37
34	Skowronski, M	Physics, Applied [17] Crystallography [7] Engineering, Electrical & Electronic [6] Materials Science, Coatings & Films [3] Materials Science, Multidisciplinary [3]	defects [13] growth [11] dislocations [7] LAYERS [6] FILMS [5] SINGLE-CRYSTALS [5] MOLECULAR-BEAM EPITAXY [5] WAFERS [5]	24% of 34

29	Tilton, R D	Chemistry, Physical [16] Chemistry, Multidisciplinary [8] Environmental Sciences [3] Materials Science, Multidisciplinary [3] Engineering, Environmental [3]	silica [11] adsorption [6] AQUEOUS-SOLUTIONS [5] polymers [4] NONIONIC SURFACTANTS [4] PARTICLES [4] SODIUM DODECYL-SULFATE [4] transport [4] surfaces [4] COADSORPTION [4] kinetics [4]	38% of 29
24	Sheiko, S S	Polymer Science [12] Chemistry, Multidisciplinary [6] Chemistry, Physical [3] Physics, Multidisciplinary [2]	TRANSFER RADICAL POLYMERIZATION [13] cylindrical brushes [7] polymers [6] molecular brushes [6] MACROMOLECULES [6] MACROMONOMERS [6] TRANSITION [6] VISUALIZATION [6] styrene [6]	29% of 24
23	Zhu, J G	Physics, Applied [16] Engineering, Electrical & Electronic [7] Materials Science, Multidisciplinary [3] Physics, Condensed Matter [3] Physics, Multidisciplinary [2]	DEPENDENCE [5] CoNi/Pt multilayers [5] FILMS [4] microstructure [4] VOLTAGE [3]	61% of 23
23	Lowry, G V	Chemistry, Multidisciplinary [12] Environmental Sciences [8] Engineering, Environmental [7] Materials Science, Multidisciplinary [3] Chemistry, Physical [2]	ZERO-VALENT IRON [6] Effect [4] water [4] nanoparticles [4] DNAPL [3] CARBON-TETRACHLORIDE [3] DEGRADATION [3] DECHLORINATION [3] GRANULAR IRON [3] ZEROVALENT IRON [3] REDUCTIVE DECHLORINATION [3] transport [3] POROUS-MEDIA [3]	48% of 23
22	Greve, D W	Physics, Applied [13] Materials Science, Multidisciplinary [9] Engineering, Electrical & Electronic [5] Physics, Condensed Matter [4] Chemistry, Physical [3]	MOLECULAR-BEAM EPITAXY [7] GaN [7] growth [6] RECONSTRUCTIONS [6] POLARITY [6]	0% of 22

		Materials Science, Coatings & Films [3]		
20	Dufour, B	Chemistry, Multidisciplinary [12] Polymer Science [5] Chemistry, Physical [3] Materials Science, Multidisciplinary [3]	polyacrylonitrile [6] TRANSFER RADICAL POLYMERIZATION [6] synthesis [5] nanostructured carbons [3] surface [3] LIQUID-CHROMATOGRAPHY [3] MOLECULAR-SIEVES [3] block copolymers [3] block-copolymers [3]	40% of 20
12	Barmak, K	Materials Science, Multidisciplinary [6] Physics, Applied [6] Physics, Condensed Matter [3] Metallurgy & Metallurgical Engineering [2] Engineering, Electrical & Electronic [2]	microstructure [4] growth [3] permanent magnets [2] thin films [2] COPT/CO [2] FILMS [2] THIN-FILMS [2] GRAIN-STRUCTURE [2] INTERDIFFUSION [2] anisotropy [2] MICROSTRUCTURE EVOLUTION [2] CU [2] PERMANENT-MAGNETS [2] exchange spring [2]	0% of 12
6	Bockstaller, M R	Materials Science, Multidisciplinary [2] Chemistry, Multidisciplinary [2]	DIBLOCK COPOLYMERS [2] OPTICAL-PROPERTIES [2] PHASE-BEHAVIOR [2] PERSPECTIVES [2] nanoparticles [2]	83% of 6
3	McGaughey, A J H	None	None	100% of 3
3	Peteanu, L A	Chemistry, Multidisciplinary [2]	MEH-PPV [2] oligomers [2]	33% of 3
2	Nain, A S	Physics, Applied [2]	ELECTROSPUN NANOFIBERS [2]	100% of 2
1	Listak, J	None	None	100% of 1
1	Reed, M L	None	None	0% of 1

Table 6(B): Research Profiles of Select Top University of Pittsburgh Nano Researchers

# Pubs	Authors	Subject Category	Key Terms	Publication Year
100	YATES, J T	Chemistry, Physical [48] Chemistry, Multidisciplinary [19] Physics, Atomic, Molecular & Chemical [17] Physics, Applied [13] Physics, Condensed Matter [9]	adsorption [46] surface [22] SCANNING-TUNNELING-MICROSCOPY [17] oxidation [17] SURFACES [16] oxygen [16]	29% of 100
69	BALAZS, A C	Polymer Science [23] Chemistry, Physical [12] Chemistry, Multidisciplinary [10] Physics, Atomic, Molecular & Chemical [9] Materials Science, Multidisciplinary [5]	nanocomposites [18] NANOPARTICLES [16] MIXTURES [16] diblock copolymers [13] MODEL [12]	22% of 69
52	Johnson, J K	Chemistry, Physical [19] Physics, Atomic, Molecular & Chemical [16] Chemistry, Multidisciplinary [7] Materials Science, Multidisciplinary [5] Physics, Multidisciplinary [4] Nanoscience & Nanotechnology [4]	adsorption [19] carbon nanotubes [15] HYDROGEN ADSORPTION [12] graphite [12] molecular simulation [9] GASES [9] MOLECULAR-DYNAMICS SIMULATIONS [9]	27% of 52
38	WALDECK, D H	Chemistry, Physical [27] Chemistry, Multidisciplinary [7] Materials Science, Multidisciplinary [6] Nanoscience & Nanotechnology [4] Physics, Atomic, Molecular & Chemical [2] Physics, Condensed Matter [2]	self-assembled monolayers [17] cytochrome c [11] GOLD ELECTRODES [9] GOLD [7] REORGANIZATION ENERGY [6] electron [6] TRANSFER KINETICS [6]	26% of 38
38	Walker, G C	Chemistry, Multidisciplinary [16] Chemistry, Physical [15] Biotechnology & Applied Microbiology [2] Marine & Freshwater Biology [2] Materials Science, Multidisciplinary [2] Engineering, Chemical [2] Mechanics [2]	atomic force microscopy [8] ATOMIC-FORCE MICROSCOPY [8] SURFACES [6] SPECTROSCOPY [6] surface [5] films [5] AFM [5] self-assembled monolayers [5]	8% of 38
28	Levy, J	Physics, Applied [10] Physics, Condensed Matter [5] Materials Science, Multidisciplinary [5] Physics, Atomic, Molecular & Chemical [4] Physics, Multidisciplinary [3] Chemistry, Physical [3]	silicon [6] force microscopy [6] surface [5] CRYSTALS [5] OPTICAL MICROSCOPY [5]	32% of 28

27	ASHER, S A	Chemistry, Multidisciplinary [16] Chemistry, Physical [4] Polymer Science [2] Materials Science, Multidisciplinary [2] Chemistry, Analytical [2]	diffraction [12] ARRAYS [7] FILTER [5] synthesis [4] photonic crystals [4] IONIC-STRENGTH [4]	4% of 27
26	Mao, S X	Materials Science, Multidisciplinary [12] Physics, Applied [12] Metallurgy & Metallurgical Engineering [4] Crystallography [3] Engineering, Multidisciplinary [3]	THIN-FILMS [6] METALS [5] behavior [5] nanobelts [5] NANORODS [4] deformation [4] OXIDE [4] growth [4] nanocrystalline nickel [4] nanowires [4]	38% of 26
26	Yang, J C	Chemistry, Physical [10] Materials Science, Multidisciplinary [6] Physics, Applied [6] Physics, Multidisciplinary [3] Physics, Condensed Matter [3] Materials Science, Coatings & Films [3]	oxidation [14] Cu2O [9] growth [8] THIN-FILMS [7] CU(001 [7] ELECTRON-MICROSCOPY [7] nucleation [7]	23% of 26
25	Snoke, D W	Physics, Condensed Matter [18] Physics, Applied [5] Optics [4] Physics, Mathematical [2]	coupled quantum wells [9] excitons [9] transport [7] GAS [7] indirect excitons [7]	32% of 25
24	CHOYKE, W J	Physics, Applied [10] Chemistry, Physical [5] Physics, Condensed Matter [4] Engineering, Electrical & Electronic [4] Materials Science, Multidisciplinary [4]	silicon [6] SPECTROSCOPY [4] adsorption [4] deposition [4] photoluminescence [4]	4% of 24
23	Borguet, E	Chemistry, Physical [12] Chemistry, Multidisciplinary [6] Materials Science, Multidisciplinary [3] Physics, Atomic, Molecular & Chemical [2] Engineering, Environmental [2] Environmental Sciences [2]	adsorption [11] oxidation [5] self-assembled monolayers [5] graphite [5] electrochemical interfaces [4] DESORPTION [4]	13% of 23
17	Lee, J	Chemistry, Physical [12] Chemistry, Multidisciplinary [3] Physics, Multidisciplinary [2] Physics, Condensed Matter [2] Materials Science, Multidisciplinary [2]	Cu(110) [7] adsorption [7] SURFACES [6] surface [4] Ag(110) [3]	76% of 17

		Nanoscience & Nanotechnology [2]	DYNAMICS [3] SPECTROSCOPY [3] interfaces [3] chemisorption [3] MOLECULES [3] ORIENTATION [3] oxygen [3] Au(111 [3]	
17	JORDAN, K D	Chemistry, Physical [9] Physics, Atomic, Molecular & Chemical [5] Multidisciplinary Sciences [2]	adsorption [7] METALS [5] SCANNING-TUNNELING-MICROSCOPY [5] MOLECULAR-DYNAMICS [5] PSEUDOPOTENTIALS [5] TOTAL-ENERGY CALCULATIONS [5] WAVE BASIS-SET [5]	29% of 17
17	Akhremitchev, B B	Chemistry, Multidisciplinary [7] Chemistry, Physical [6]	atomic force microscopy [6] films [4] surface [3] SURFACES [3] polydispersity [3]	0% of 17
14	Kim, H K	Physics, Applied [10] Chemistry, Multidisciplinary [2] Materials Science, Multidisciplinary [2] Optics [2]	NARROW SLITS [5] transmission [5] LIGHT [5] NANOPARTICLES [4] GRATINGS [3]	43% of 14
10	Petek, H	Chemistry, Multidisciplinary [3] Multidisciplinary Sciences [3] Materials Science, Multidisciplinary [2]	SURFACES [4] coherent control [3] time-resolved photoemission [3] DYNAMICS [3] NANOPARTICLES [2] PHOTOEMISSION ELECTRON-MICROSCOPY [2] STATES [2] METALS [2] SPECTROSCOPY [2] femtosecond microscopy [2] water [2] EXCITATION [2]	60% of 10
7	YANG, J	Chemistry, Multidisciplinary [2] Chemistry, Organic [2]	SOLID-STATE [4] MOLECULAR RECOGNITION [3] DESIGN [3] HYDROGEN-BONDING CONTROL [3] RECOGNITION [3]	29% of 7

7	Star, A	Materials Science, Multidisciplinary [6] Nanoscience & Nanotechnology [5] Chemistry, Multidisciplinary [4] Chemistry, Physical [3] Physics, Applied [2]	field-effect transistors [4] adsorption [3] chemical sensors [3] NO2 [2] sensitivity [2] sensors [2] SINGLE [2] proteins [2] BIOSENSORS [2] SEPARATION [2] FUNCTIONALIZATION [2] CHARGE-TRANSFER [2] CONTACT [2] DEVICES [2]	100% of 7
5	Kuksenok, O	Chemistry, Physical [2]	PHASE-SEPARATION [3] morphology [3] MIXTURES [2] polymer blends [2] FLOW [2] LIGHT [2] DEFECT-FREE [2]	40% of 5
5	Amemiya, S	Chemistry, Analytical [3]	electrochemical microscopy [3] scanning electrochemical microscopy [3] SECM [3] NUCLEOCYTOPLASMIC TRANSPORT [2] PORE COMPLEX [2] fabrication [2] DIFFUSION-COEFFICIENTS [2] PROBING ION TRANSFER [2] BILAYER-LIPID MEMBRANES [2] nuclear envelope [2] feedback mode [2]	60% of 5
3	Cole, D G	Physics, Applied [3]	atomic force microscope based nanofabrication [2] master pattern molds [2] USE [2] NANOLITHOGRAPHY [2] nano-oxidation [2]	100% of 3
3	Gao, D	None	None	100% of 3
2	Li, G Y	None	None	100% of 2
1	Gray, J L	None	None	100% of 1

Figure 2 maps the leading nano researchers (and workshop attendees with multiple nano publications) at Carnegie Mellon University based on their tendency to co-author these SCI-indexed publications. Such “research network” depictions can help understand “at a glance” who works with whom (i.e., research teaming). [Obviously, many caveats apply; this intends to help attendees identify research groups and suitable contacts.

Figure 3 maps the leading nano researchers (and workshop attendees with multiple nano publications) at the University of Pittsburgh based on their tendency to co-author these SCI-indexed publications. Such “research network” depictions can help understand “at a glance” who works with whom (i.e., research teaming). [Obviously, many caveats apply; this intends to help attendees identify research groups and suitable contacts.

Figure 2. Carnegie Mellon University Nano Co-authorship-based Networks

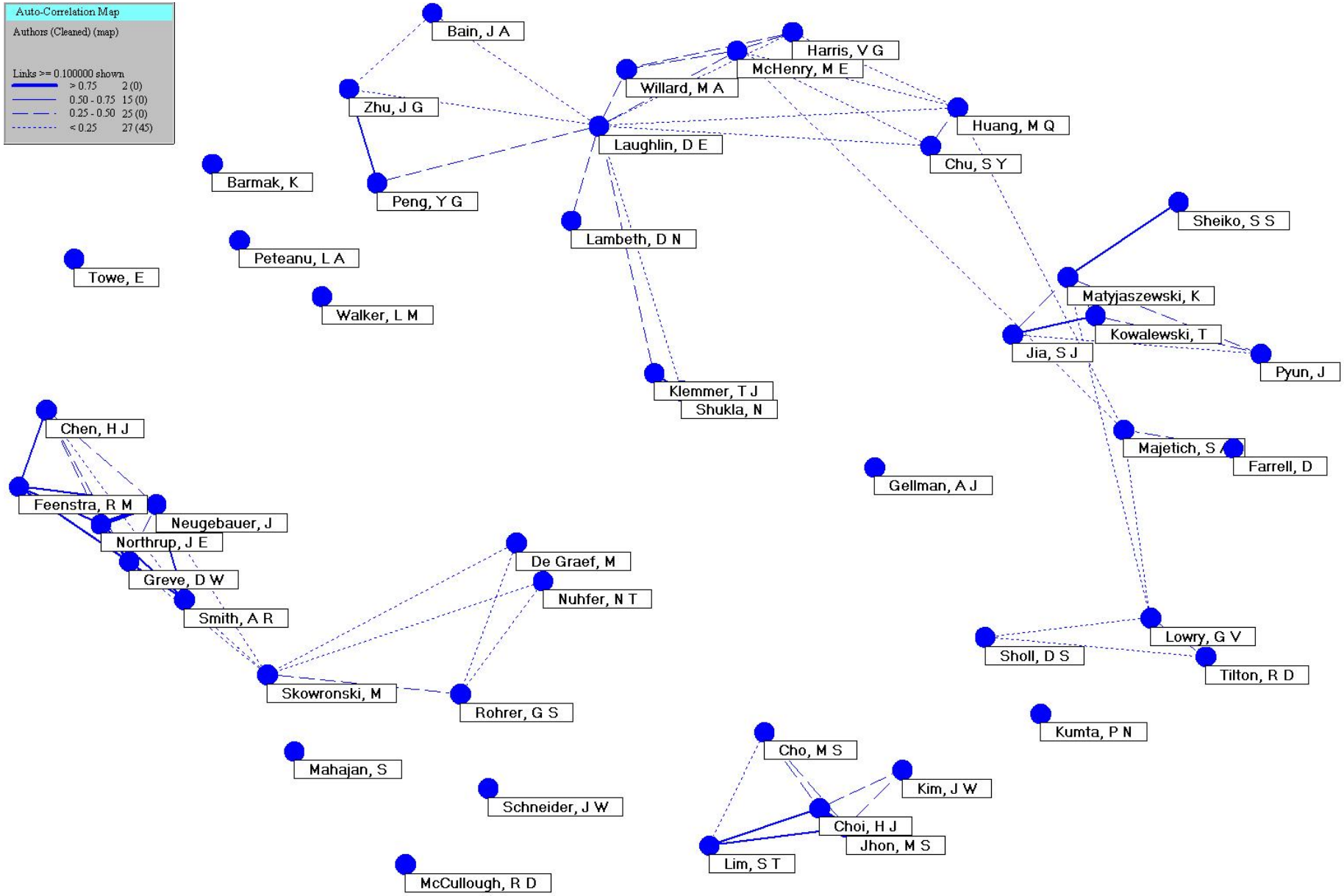


Figure 3. University of Pittsburgh Nano Co-authorship-based Networks