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Published:
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[Continued on next page]

(54) **Title:** DECONTAMINATION MATERIALS, METHODS FOR REMOVING CONTAMINANT MATTER FROM A POROUS MATERIAL AND SYSTEMS AND STRIPPABLE COATINGS FOR DECONTAMINATING STRUCTURES THAT INCLUDE POROUS MATERIAL

IRRADIATE STRUCTURE WITH ELECTROMAGNETIC RADIATION TO CAUSE REDISTRIBUTION OF CONTAMINANT MATTER

APPLY POLYMER MATERIAL CONFIGURED TO BIND TO CONTAMINANT MATTER TO STRUCTURE

REMOVE POLYMER MATERIAL TOGETHER WITH CONTAMINANT MATTER BOUND THERETO FROM STRUCTURE

(57) **Abstract:** Methods of removing contaminant matter from porous materials include applying a polymer material to a contaminated surface, irradiating the contaminated surface to cause redistribution of contaminant matter, and removing at least a portion of the polymer material from the surface. Systems for decontaminating a contaminated structure comprising porous material include a radiation device configured to emit electromagnetic radiation towards a surface of a structure, and at least one spray device configured to apply a capture material onto the surface of the structure. Polymer materials that can be used in such methods and systems include polyphosphazine-based polymer materials having polyphosphazine backbone segments and side chain groups that include selected functional groups. The selected functional groups may include iminos, oximes, carboxylates, sulfonates, β -diketones, phosphine sulfides, phosphates, phosphites, phosphonates, phosphinates, phosphine oxides, monothio phosphinic acids, and dithio phosphinic acids.

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INTERNATIONAL SEARCH REPORT

International application No.

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A. CLASSIFICATION OF SUBJECT MATTER

Int. Cl. *C08G 79/02* (2006.01) ***B08B 7/00***(2006.01) ***B08B 5/70***(2006.01) *C09K 3/00* (2006.01)
 US Cl. 528/168

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPIDS, JAPIO, CAPLUS: & keywords: polyphosphazene, polyphosphazine, film, coat, amin, keton, imin, sulfon, carbox, phosphat, azin, amid, & similar terms; IPC *B08B H-, 3I-* & keywords: porous, polymer, & similar terms

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 1993/012468 A1 (HOECHST CELANESE CORPORATION) 24 June 1993 See page 8 line 2 1-page 9 line 15, in particular page 9 lines 8-1 1	1, 9
X	WO 1995/032736 A1 (THE PENN STATE RESEARCH FOUNDATION) 7 December 1995 See page 14 line 15-page 15 line 26, in particular page 14 line 30, page 18 lines 15-17	1, 2, 9
X	US 6876125 B2 (BASHEER et al) 5 April 2005 See column 2 lines 1-16, column 4 line 4	1, 2, 9
Y	See column 2 lines 1-16, column 4 line 4	3-6

 Further documents are listed in the continuation of Box C See patent family annex

♦ Special categories of cited documents'		
"A" document defining the general state of the art which is not considered to be of particular relevance	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention	
"E" earlier application or patent but published on or after the international filing date	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone	
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art	
"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family	
"P" document published prior to the international filing date but later than the priority date claimed		

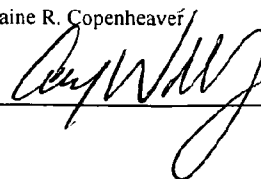
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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2007/066139

Box No. II Observations where certain claims were found unsearchable (Continuation of item 2 of first sheet)

This international search report has not been established in respect of certain claims under Article 17(2)(a) for the following reasons:

- 1 Claims Nos.:
because they relate to subject matter not required to be searched by this Authority, namely:

- 2. Claims Nos.:
because they relate to parts of the international application that do not comply with the prescribed requirements to such an extent that no meaningful international search can be carried out, specifically.

- 3 Claims Nos.:
because they are dependent claims and are not drafted in accordance with the second and third sentences of Rule 6.4(a)

Box No. III Observations where unity of invention is lacking (Continuation of item 3 of first sheet)

This International Searching Authority found multiple invention; in this international application, as follows:

See Supplemental Box

- 1. As all required additional search fees were timely paid by the applicant, this international search report covers all searchable claims
- 2. As all searchable claims could be searched without effort justifying additional fees, this Authority did not invite payment of additional fees.
- 3 As only some of the required additional search fees were timely paid by the applicant, this international search report covers only those claims for which fees were paid, specifically claims Nos.

- 4 No required additional search fees were timely paid by the applicant. Consequently, this international search report is restricted to the invention first mentioned in the claims; it is covered by claims Nos.:

Remark on Protest

- The additional search fees were accompanied by the applicant's protest and, where applicable, the payment of a protest fee.
- The additional search fees were accompanied by the applicant's protest but the applicable protest fee was not paid within the time limit specified in the invitation.
- No protest accompanied the payment of additional search fees.

INTERNATIONAL SEARCH REPORT

International application No.
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C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 6093758 A (ALLCOCK et al) 25 July 2000 See compounds 10, 11	1, 7
X	US 2004/0033406 A1 (ANDRIANOV et al) 19 February 2004 See paragraphs [0019], [0033], [0047]	1, 2, 9
<u>X</u>	US 5548060 A (ALLCOCK et al) 20 August 1996 <u>See column 8 lines 36-50, Fig 3B, claims 5, 15</u>	<u>1, 2</u>
Y	See column 8 lines 36-50, Fig 3B, claims 5, 15	8
Y	US 5464932 A (ALLCOCK et al) 7 November 1995 See column 3 lines 19-22	3
Y	US 4959442 A (OHKAWA et al) 25 September 1990 See column 8 line 60, examples	4-6, 8
<u>X</u>	US 577981 1 A (MACHII et al) 14 July 1998 <u>column 6 line 52, Fig 4B</u>	<u>10, 13, 14, 39</u>
Y	column 6 line 52, Fig 4B	11, 12, 23, 24, 30, 31
Y	US 4586962 A (BARABAS) 6 May 1986 See the whole document	11, 12
Y	US 5763734 A (NACHTMAN et al) 9 June 1998 See column 6 lines 11-15, 64-67, column 8 lines 11-27	11, 12, 23, 24, 30, 31
X	US 5868840 A (KLEIN, II et al) 9 February 1999 See the whole document	40-44
X	US 4844947 A (KASNER et-al) 4 July 1989 See the whole document	40-49

Supplemental Box

(To be used when the space in any of Boxes I to VHI is not sufficient)

Continuation of Box No: III

This International Application does not comply with the requirements of unity of invention because it does not relate to one invention or to a group of inventions so linked as to form a single general inventive concept.

In assessing whether there is more than one invention claimed, I have given consideration to those features which can be considered to potentially distinguish the claimed combination of features from the prior art. Where different claims have different distinguishing features they define different inventions.

This International Searching Authority has found that there are different inventions as follows:

- Claims 1-9 are directed to a polyphosphazine-based polymer. It is considered that the polymer having the structure defined in claim 1 comprises a first distinguishing feature.
- Claims 10-39 are directed to a method of removing contaminant matter from a porous material. Claims 40-49 are directed to a system for decontaminating a structure comprising porous material. It is considered that the method comprising applying a polymer to a surface of the porous material, irradiating the surface and removing at least a portion of the polymer material and/or a system comprising at least one radiation device which can emit electromagnetic radiation towards the surface of the structure and one spray device which can apply a capture material onto the surface of the structure comprises a second distinguishing feature.

PCT Rule 13.2, first sentence, states that unity of invention is only fulfilled when there is a technical relationship among the claimed inventions involving one or more of the same or corresponding special technical features. PCT Rule 13.2, second sentence, defines a special technical feature as a feature which makes a contribution over the prior art.

Each of the abovementioned groups of claims has a different distinguishing feature and they do not share any feature which could satisfy the requirement for being a special technical feature. Because there is no common special technical feature it follows that there is no technical relationship between the identified inventions. Therefore the claims do not satisfy the requirement of unity of invention *a priori*

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2007/066139

This Annex lists the known "A" publication level patent family members relating to the patent documents cited in the above-mentioned international search report. These particulars are merely given for the purpose of information.

Patent Document Cited in Search Report		Patent Family Member					
WO	9312468	US	5248585				
WO	9532736	AU	26581/95				
US	6876125	US	2005046313				
US	6093758	NONE					
US	2004033406	AU	2003240532	EP	1551904	US	7169499
		WO	03102050				
US	5548060	NONE					
US	5464932	AU	23874/95	WO	9528150		
US	4959442	EP	0286709	JP	63022843		
US	577981 1	EP	0681875	JP	8019767		
US	4586962	AU	15102/83	AU	19301/83	CA	1192479
		CA	1240229	DK	436283	DK	548583
		EP	0091301	EP	0180617	JP	59123778
		NO	833753	NO	834405	US	4424079
		US	4451296	US	4517023	US	4521253
		WO	8303429	WO	8505294		
US	5763734	NONE					
US	5868840	NONE					
US	4844947	DE	3737455	GB	2197500	GB	2237657
		GB	2237896	JP	63 134075		
END OF ANNEX							