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(54) **Electroluminescent iridium compounds with fluorinated phenylpyridines, phenylpyrimidines, and phenylquinolines and devices made with such compounds**

(57) The present invention is generally directed to electroluminescent Ir(III) compounds, the substituted 2-phenylpyridines, phenylpyrimidines and phenylquino-

lines that are used to make the Ir(III) compounds, and devices that are made with the Ir(III) compounds.

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EUROPEAN SEARCH REPORT

Application Number
EP 04 00 4542

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
D,A	DJUROVICH PETER I ET AL: "Ir(III) CYCLOMETALATED COMPLEXES AS EFFICIENT PHOSPHORESCENT EMITTERS IN POLYMER BLEND AND ORGANIC LEDs" POLYMER PREPRINTS, vol. 41, no. 1, March 2000 (2000-03), pages 770-771, XP001052648 * the whole document *	1-14	INV. H05B33/14 C09K11/06 C07F15/00 C07D213/61 C07D213/26 C07D213/68 C07D239/26 H01L51/30
A	CHATANI N; IE Y; KAKIUCHI F; MURAI S: "Ru ₃ (CO) ₁₂ -Catalyzed Reaction of Pyridylbenzenes with Carbon Monoxide and Olefins. Carbonylation at a C-H Bond in the Benzene Ring" JOURNAL OF ORGANIC CHEMISTRY, vol. 62, no. 8, 1997, pages 2604-2610, XP002201286 * page 2606, column 2 *	1-14	
A	GOSMINI C; NÉDÉLEC J Y; PÉRICHON J: "Electrosynthesis of functionalized 2-arylpyridines from functionalized aryl and pyridine halides catalyzed by nickel bromide 2,2'-bipyridine complex" TETRAHEDRON LETTERS, vol. 41, 24 June 2000 (2000-06-24), pages 5039-5042, XP002201287 * table 2 *	1-14	TECHNICAL FIELDS SEARCHED (IPC) H05B C09K H01L C07F C07D
A	CACCHI S; FABRIZI G; MARINELLI F: "The Palladium-Catalyzed Transfer Hydrogenation/Heterocyclization of beta-(2-Aminophenyl)-alpha,beta-ynones. An Approach to 2-Aryl- and 2-Vinylquinolines" SYNLETT, 24 June 2000 (2000-06-24), XP002201288 scheme 1, scheme 2, table 1, compound 1e ----- -/-	1-14	
13 The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 17 November 2008	Examiner Lehnert, Andreas
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03/02 (P04C01)



EUROPEAN SEARCH REPORT

Application Number
EP 04 00 4542

DOCUMENTS CONSIDERED TO BE RELEVANT				
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)	
A	BALDO M A ET AL: "VERY HIGH-EFFICIENCY GREEN ORGANIC LIGHT-EMITTING DEVICES BASED ON ELECTROPHOSPHORESCENCE" APPLIED PHYSICS LETTERS, AMERICAN INSTITUTE OF PHYSICS. NEW YORK, US, vol. 75, no. 1, 5 July 1999 (1999-07-05), pages 4-6, XP000850655 ISSN: 0003-6951 * the whole document *	1-14		
A	BALDO M A ET AL: "High-efficiency fluorescent organic light-emitting devices using a phosphorescent sensitizer" NATURE, MACMILLAN JOURNALS LTD. LONDON, GB, vol. 403, no. 6771, 17 February 2000 (2000-02-17), pages 750-753, XP002183466 ISSN: 0028-0836 * the whole document *	1-14		
A	WO 96/03410 A (FROMMBERGER BRUNO ;VOEGTLE FRITZ (DE); HERRMANN RUPERT (DE); ISSBE) 8 February 1996 (1996-02-08) * claims 1,2,20,21 *	1-14		TECHNICAL FIELDS SEARCHED (IPC)
A	DATABASE CAPLUS [Online] CHEMICAL ABSTRACTS SERVICE, COLUMBUS, OHIO, US; WANG, YUE ET AL: "(Hydroxyphenyl)pyridine derivative, its metal complexes and application a electroluminescence material" XP002201289 retrieved from STN Database accession no. 133:315395 * abstract *	1-14		
-The present search report has been drawn up for all claims				
Place of search The Hague		Date of completion of the search 17 November 2008	Examiner Lehnert, Andreas	
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document		

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EPO FORM 1503 03.82 (P04C01)



EUROPEAN SEARCH REPORT

Application Number
EP 04 00 4542

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	& CN 1 245 822 A (JILIN UNIV., PEOP. REP. CHINA) 1 March 2000 (2000-03-01) ----- DEDEIAN ET AL: "A NEW SYNTHETIC ROUTE TO THE PREPARATION OF A SERIES OF STRONG PHOTOREDUCING AGENTS: FAC TRIS-ORTHO-METALATED COMPLEXES OF IRIIDIUM (III) WITH SUBSTITUTED 2-PHENYLPYRIDINES" INORGANIC CHEMISTRY, AMERICAN CHEMICAL SOCIETY, EASTON, US, vol. 30, no. 30, 1991, pages 1685-1687, XP001070331 ISSN: 0020-1669 * the whole document * -----	1-14	
			TECHNICAL FIELDS SEARCHED (IPC)
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 17 November 2008	Examiner Lehnert, Andreas
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03/82 (P04C01)



Application Number

EP 04 00 4542

CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing claims for which payment was due.

- ☐ Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due and for those claims for which claims fees have been paid, namely claim(s):
- ☒ No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for those claims for which no payment was due.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

- ☐ All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.
- ☐ As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.
- ☐ Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:
- ☐ None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:
- ☐ The present supplementary European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims (Rule 164 (1) EPC).

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 04 00 4542

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

17-11-2008


Patent document cited in search report		Publication date		Patent family member(s)		Publication date
WO 9603410	A	08-02-1996	AT	187732	T	15-01-2000
			CN	1152923	A	25-06-1997
			EP	0772616	A1	14-05-1997
			ES	2143059	T3	01-05-2000
			JP	10503485	T	31-03-1998
			JP	3583436	B2	04-11-2004
			US	5981286	A	09-11-1999

CN 1245822	A	01-03-2000	NONE			

专利名称(译)	具有氟化苯基吡啶，苯基嘧啶和苯基喹啉的电致发光铱化合物和用这些化合物制成的装置		
公开(公告)号	EP1431288A3	公开(公告)日	2008-12-24
申请号	EP2004004542	申请日	2001-06-27
[标]申请(专利权)人(译)	纳幕尔杜邦公司		
申请(专利权)人(译)	E.I.DU PONT DE NEMOURS AND COMPANY		
当前申请(专利权)人(译)	E·I·杜邦和公司		
[标]发明人	PETROV VIACHESLAV A WANG YING GRUSHIN VLADIMIR		
发明人	PETROV, VIACHESLAV A. WANG, YING GRUSHIN, VLADIMIR		
IPC分类号	H05B33/14 C09K11/06 C07F15/00 C07D213/61 C07D213/26 C07D213/68 C07D239/26 H01L51/30 H01L51/50 C07D213/30 C07D215/04 C07D215/12 H01L51/00		
CPC分类号	H05B33/14 C07D213/26 C07D213/30 C07D213/61 C07D213/68 C07D215/04 C07D239/26 C07F15 /0033 C09K11/06 C09K2211/1007 C09K2211/1011 C09K2211/1014 C09K2211/1029 C09K2211/185 H01L51/005 H01L51/0084 H01L51/0085 H01L51/50 H01L51/5012 Y10S428/917		
代理机构(译)	TOWLER , PHILIP DEAN		
优先权	60/224273 2000-08-10 US 60/215362 2000-06-30 US		
其他公开文献	EP1431288A2		
外部链接	Espacenet		

摘要(译)

本发明一般涉及电致发光Ir(III)化合物，用于制备Ir(III)化合物的取代的2-苯基吡啶，苯基嘧啶和苯基喹啉，以及用Ir(III)化合物制备的器件。

 EUROPEAN PATENT OFFICE EUROPÄISCHES PATENTAMT OFFICE EUROPÉEN DES BREVETS		EUROPEAN SEARCH REPORT		Application Number EP 04 00 4542
DOCUMENTS CONSIDERED TO BE RELEVANT				
Category	Classification according to the International Classification of the relevant passages	Relevance to claims	CLASSIFICATION OF THE APPLICATION (IPC)	
D,A	DUROVICHENKO I. S.; LIL'YAN I. I.; "1,2-(111) CYCLOMETALATED COMPLEXES AS EFFICIENT PHOSPHORESCENT EMITTERS IN POLYMER BLEND AND ORGANIC LEDS"; J. POLYM. SCI. PART A: POLYM. PREPRINTS, vol. 43, no. 1, March 2000 (2000-03), pages 770-771, XP006052648 the whole document *	1-14	INV H05B33/14 C09K11/06 C07F13/00 C07D213/61 C07D213/28 C07D213/68 H01C3/08 H01L51/30	
A	CHATANI N. I.; Y. KAKIUCHI F.; MURAI S.; "Ru(CO)2-Catalyzed Reaction of pyridyl-benzonitriles with Carbon Monoxide and Olefins. Carbonylation at a C-H Bond in the Benzene Ring"; JOURNAL OF ORGANIC CHEMISTRY, vol. 62, no. 8, 1997, pages 2604-2610, XP00201286 * page 2606, column 2 *	1-14		
A	GOSHIMI C.; MEDELEC P.; PIERICHON J.; "Electrosynthesis of functionalized 2-arylpolyridines from 2-arylpolyridine and pyridine halides catalyzed by nickel bromide 2,2'-bipyridine complex"; TETRAHEDRON LETTERS, vol. 41, no. 24, December 2000 (2000-06-24), pages 5039-5042, XP00201287 * table 2 *	1-14	TECHNICAL FIELD (IPC Class.) H05B H01L C01 C07D	
A	CACCHI S.; FABRIZI G.; MARINELLI F.; "The Palladium-Catalyzed Transfer Hydrogenation/Heterocyclization of beta-(2-Aminophenyl)-alpha,beta-unsaturated Aldehydes. An Approach to 2-Aryl- and 2-Vinylpyridines"; SYNLETT, 24 June 2000 (2000-06-24), XP00201288 scheme 1, scheme 2, table 1, compound 1e ----- * -- *	1-14		
13 - The present search report has been drawn-up for all claims				
Date of filing of the application The Hague		Date of completion of the search 17 November 2003 Examiner Lehner, Andreas		
CATEGORY OF CITED DOCUMENTS A: Internationally researched patent documents B: Documents published in the technical literature C: Technical documents D: Other documents		1: theory of principle underlying the invention 2: prior art known to the applicant 3: other relevant state of the art 4: other relevant prior art 5: other relevant prior art 6: other relevant prior art 7: other relevant prior art 8: other relevant prior art 9: other relevant prior art 10: other relevant prior art 11: other relevant prior art 12: other relevant prior art 13: other relevant prior art 14: other relevant prior art 15: other relevant prior art 16: other relevant prior art 17: other relevant prior art 18: other relevant prior art 19: other relevant prior art 20: other relevant prior art 21: other relevant prior art 22: other relevant prior art 23: other relevant prior art 24: other relevant prior art 25: other relevant prior art 26: other relevant prior art 27: other relevant prior art 28: other relevant prior art 29: other relevant prior art 30: other relevant prior art 31: other relevant prior art 32: other relevant prior art 33: other relevant prior art 34: other relevant prior art 35: other relevant prior art 36: other relevant prior art 37: other relevant prior art 38: other relevant prior art 39: other relevant prior art 40: other relevant prior art 41: other relevant prior art 42: other relevant prior art 43: other relevant prior art 44: other relevant prior art 45: other relevant prior art 46: other relevant prior art 47: other relevant prior art 48: other relevant prior art 49: other relevant prior art 50: other relevant prior art 51: other relevant prior art 52: other relevant prior art 53: other relevant prior art 54: other relevant prior art 55: other relevant prior art 56: other relevant prior art 57: other relevant prior art 58: other relevant prior art 59: other relevant prior art 60: other relevant prior art 61: other relevant prior art 62: other relevant prior art 63: other relevant prior art 64: other relevant prior art 65: other relevant prior art 66: other relevant prior art 67: other relevant prior art 68: other relevant prior art 69: other relevant prior art 70: other relevant prior art 71: other relevant prior art 72: other relevant prior art 73: other relevant prior art 74: other relevant prior art 75: other relevant prior art 76: other relevant prior art 77: other relevant prior art 78: other relevant prior art 79: other relevant prior art 80: other relevant prior art 81: other relevant prior art 82: other relevant prior art 83: other relevant prior art 84: other relevant prior art 85: other relevant prior art 86: other relevant prior art 87: other relevant prior art 88: other relevant prior art 89: other relevant prior art 90: other relevant prior art 91: other relevant prior art 92: other relevant prior art 93: other relevant prior art 94: other relevant prior art 95: other relevant prior art 96: other relevant prior art 97: other relevant prior art 98: other relevant prior art 99: other relevant prior art 100: other relevant prior art		