

2020년 8월 OLED 발광재료 특허 분석 보고서

Analyst
Dae Jeong YOON

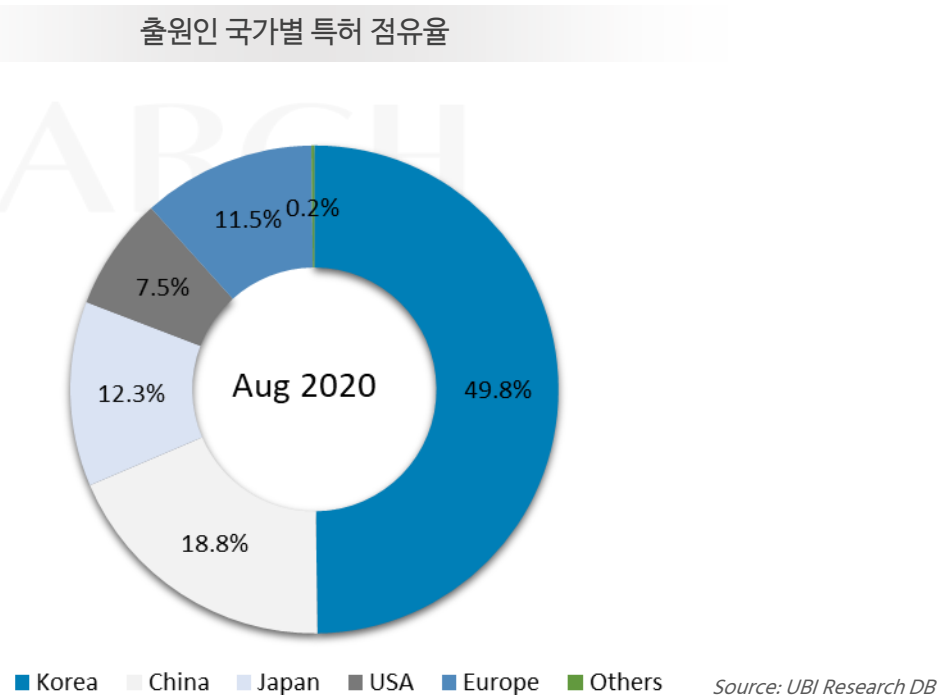
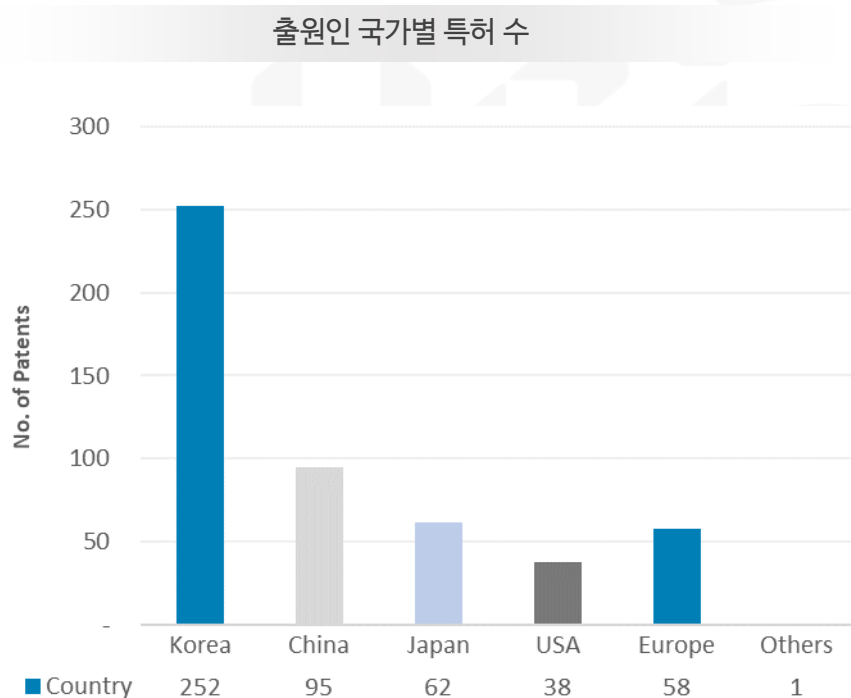
1. 분류 방법

- 2020년 8월에 공개 된(application, under examination, registration) 특허 499건을 분류하였음.
- 분류 방법은 다음과 같음.
 - 출원인 국가
 - 한국, 중국, 일본, 미국, 유럽, 그 외로 분류하였음. 한 특허에 2개 국가 이상의 출원인이 있을 경우 각각의 국가에 포함시켜 출원 국가수를 계산하였기 때문에, 총 출원인 국가 수는 공개 된 특허 수를 초과할 수도 있음.
 - 주요 업체
 - 15개 업체로 업체들은 다음과 같음. Doosan Solus, Dow chem, Duksan Neolux, Idemitsu Kosan, LG Chem, Merck, Novaled, Samsung SDI, SFC, UDC, JNC, Hodogaya, Sumitomo, Kyulux, Cynora
 - 재료별 분류(purpose)
 - EML, ETL, HTL, CPL, EML+HTL, EML+ETL, HTL+ETL, EML+HTL+ETL, Others로 분류하였음.
 - HTL에는 HIL과 HTL, EBL, R', G', B'이 포함되었음.
 - ETL에는 EIL과 ETL, HBL(aETL)이 포함되었음.
 - Others에는 QD나 Near IR, CGL 등이 포함되었음.

2. 전체 특허 분석

출원인 국가별

- 2020년 8월 공개된 특허는 499건이었으며, 2개 이상의 국가가 포함된 특허를 분류하면 총 특허 수는 506건이 되었음.
- 전체 506건의 특허 수 중 한국이 252건으로 가장 많은 특허 수를 기록하였음.
- 중국이 95건으로 2위를 차지하였으며, 일본이 62건, 유럽이 58건, 미국이 38건으로 뒤를 이었음.
- 전체 특허 중 한국 출원인의 특허 비율은 50%이며, 중국이 19%, 일본이 12% 였음.

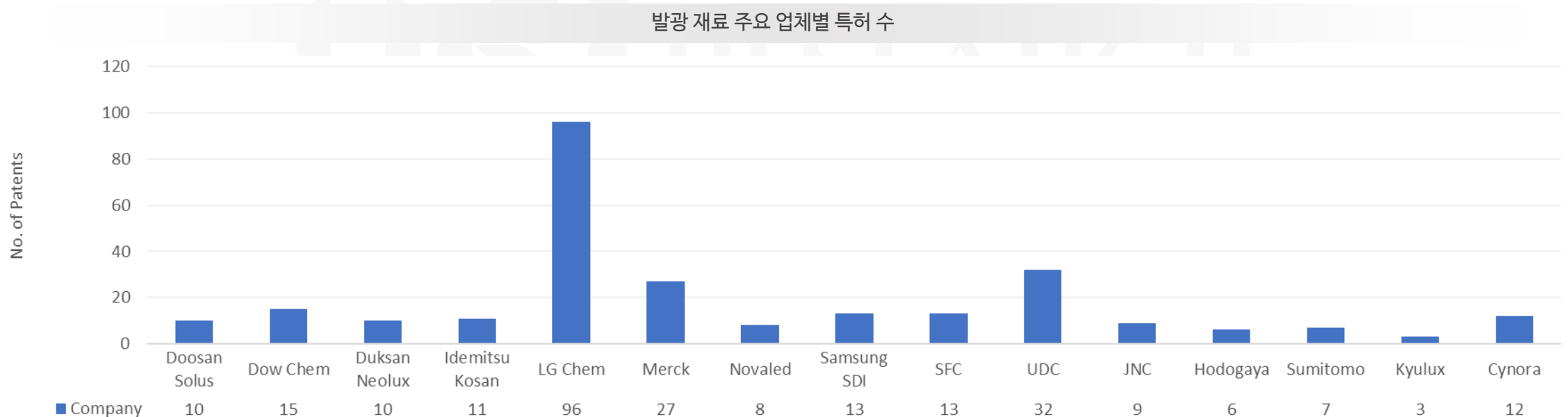


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2. 전체 특허 분석

발광 재료 주요 업체별

- 주요 업체별로는 LG Chem이 96건으로 가장 많은 특허 수를 기록하였음.
- LG Chem은 Samsung Display의 모바일 기기용 OLED향으로 ETL을 공급하고 있으며, LG Display의 모바일과 TV용으로 다수의 공통층과 발광층 재료를 공급하고 있음.
- 2위는 UDC로 32건의 특허 수를 기록하였으며, 3위는 27건을 기록한 Merck가 차지하였음.
- 차세대 발광재료로 언급되고 있는 TADF와 hyper fluorescent를 개발하고 있는 Cynora와 Kyulux는 각각 12건과 3건의 특허 수를 기록하였음.

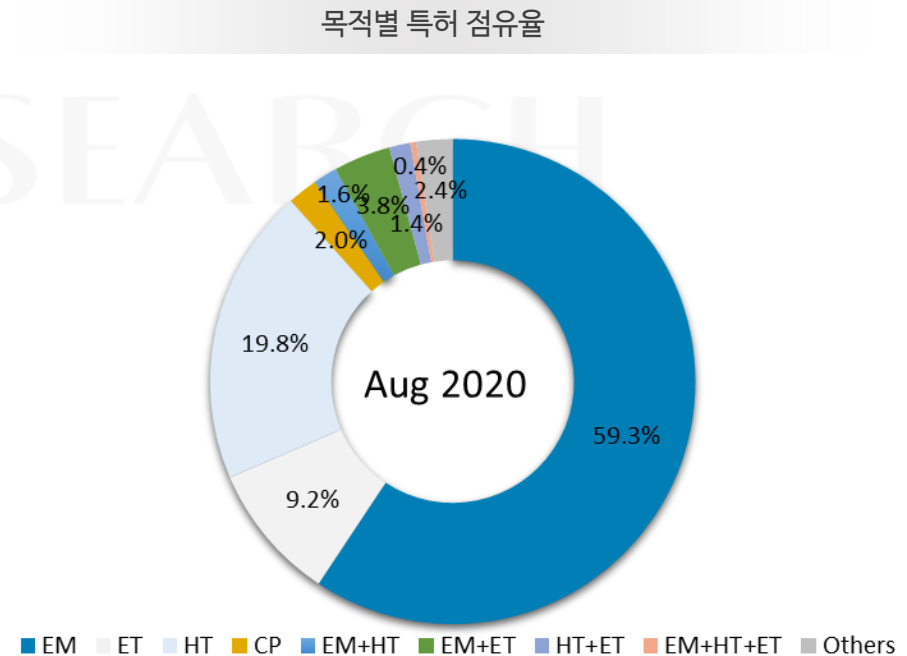
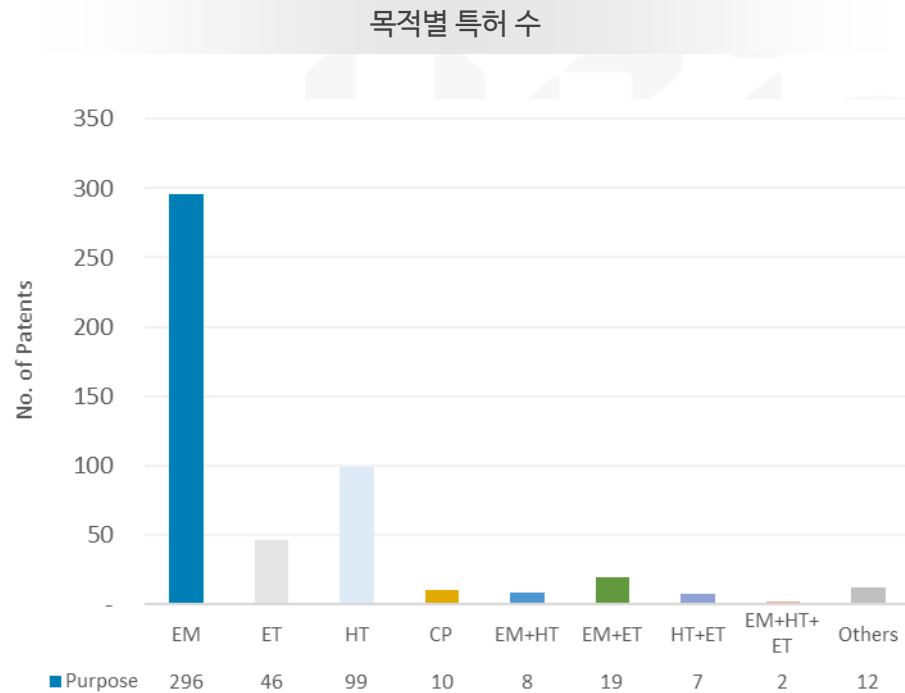


Source: UBI Research DB

2. 전체 특허 분석

■ 목적별

- 목적별 특허는 HTL과 EML, ETL 같은 레이어와 그 외 특허로 분류하였음.
- 전체 특허 중 EML용 특허 수가 296건으로 59%의 가장 많은 점유율을 차지하였으며, HTL용이 99건으로 20%, ETL용이 46건으로 9%의 점유율을 차지하였음.
- 12건의 기타 특허 중 CGL용이 7건으로 가장 많은 특허 수를 기록하였음.

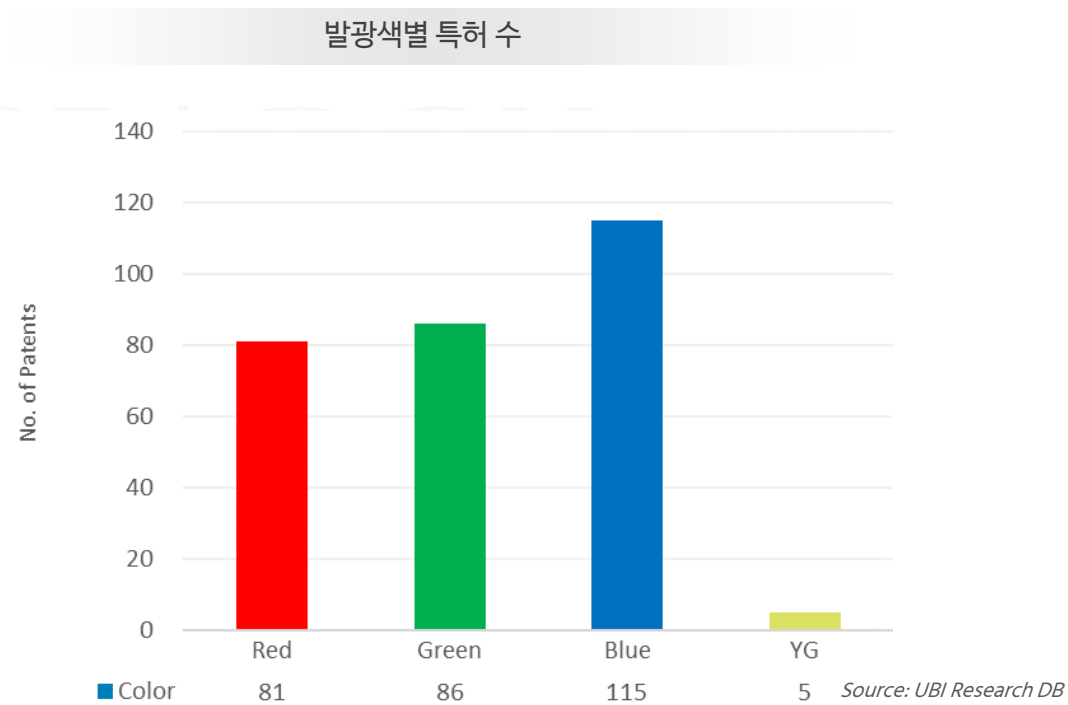
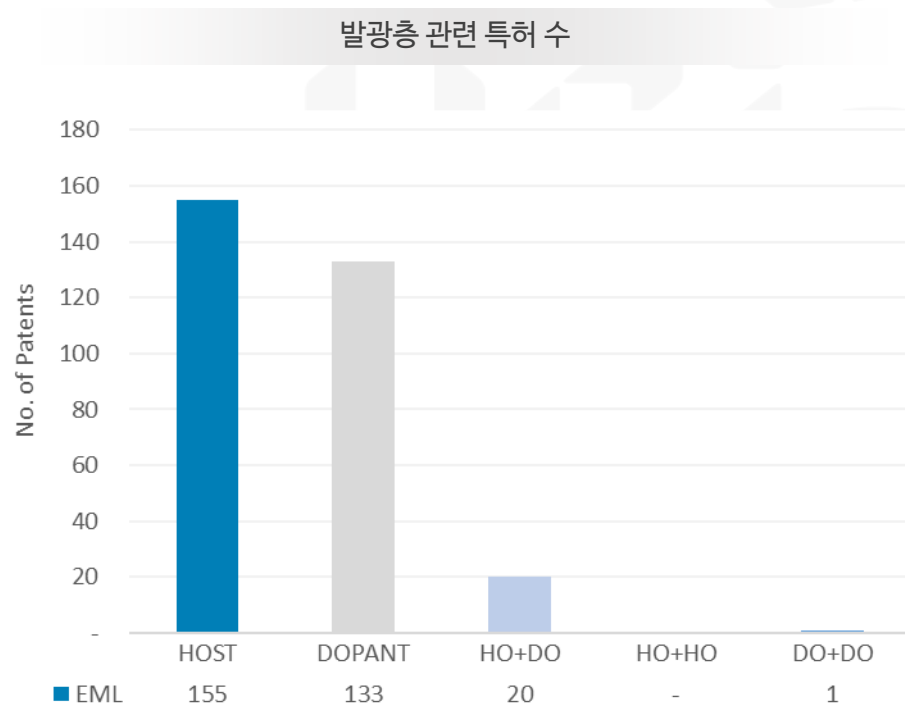


Source: UBI Research DB

2. 전체 특허 분석

발광층

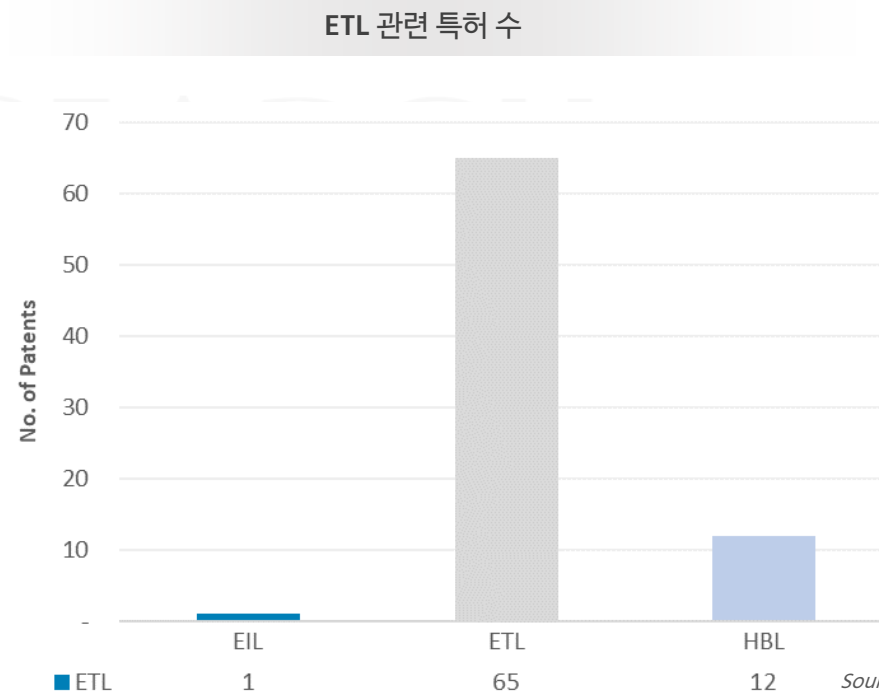
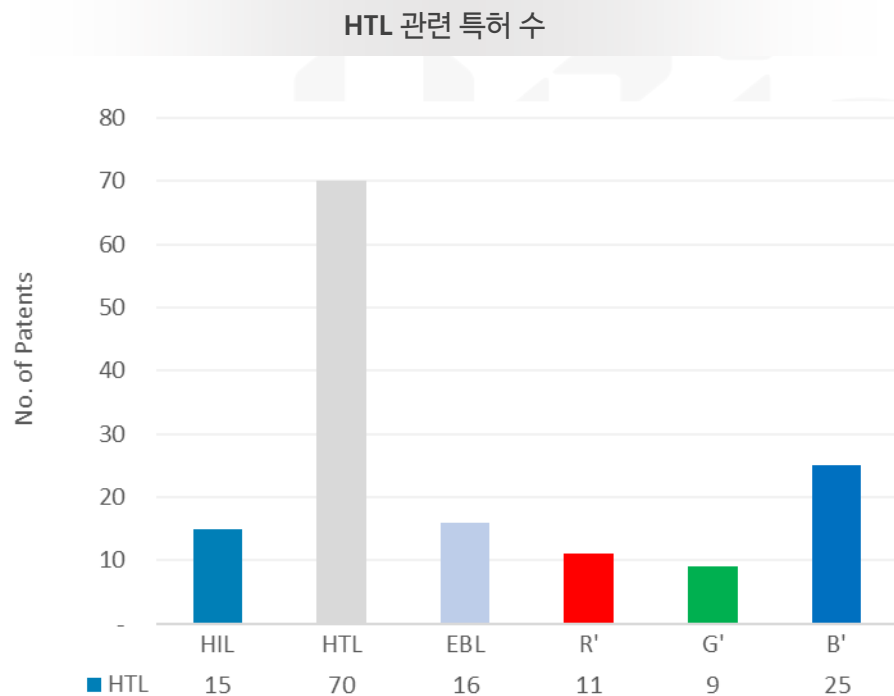
- 발광층 관련 특허 중 host 관련 특허가 155건으로 가장 많은 수를 기록 하였으며, dopant 관련 특허가 133건으로 뒤를 이었음.
- Host+host 관련 특허는 20건이었으며, dopant+dopant 관련 특허는 1건을 기록하였음.
- 색으로는 청색 관련 특허가 115건으로 가장 많은 수를 기록하였으며, 녹색이 86건, 적색이 81건을 기록하였음.
- 대면적 OLED용으로 사용되고 있는 연두색 특허는 5건을 기록하였음.



2. 전체 특허 분석

공통층

- HTL 관련 특허 중 HTL 특허가 70건으로 가장 많은 수를 기록하였으며, B'이 25건, EBL이 16건으로 뒤를 이었음.
- HTL을 주로 양산하고 있는 업체는 Idemitsu Kosan과 Doosan Solus, Duksan Neolux 등이 있으며, B'을 주로 양산하고 있는 업체는 Idemitsu Kosan와 SFC 등이 있음.
- ETL 관련 특허 중 ETL이 65건으로 가장 많은 수를 기록하였으며, HBL이 12건을 기록하였음.
- ETL을 주로 양산하고 있는 업체는 LG Chemical과 LT Materials 등이 있음.



Source: UBI Research DB

3. 특허 리뷰

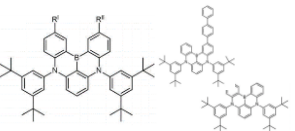
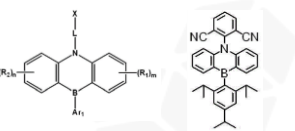
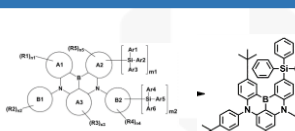
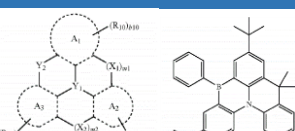
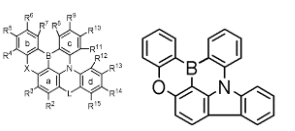
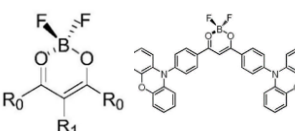
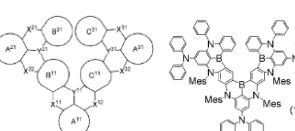
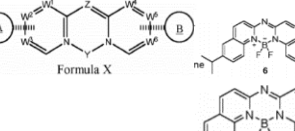
■ Blue Dopant Patents in Aug. 2020

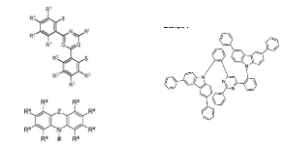
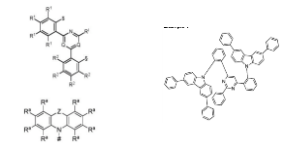
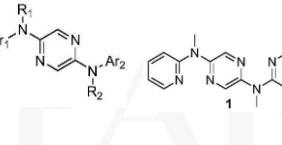
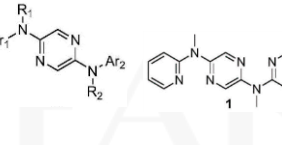
- Blue dopant patents of 90 cases have been published or registered in Aug. 2020.
- Main assignees are Samsung display(12 cases), LG chem(11 cases) and Cynora(11 cases).
- Phenyl core TADF dopants substituted with various EDG and EWG ligands are the most. Cynora is pending these patents. Several companies, including JNC, have applied for patents on TADF materials containing boron. SFC registered the patent of DABNA fused dibenzofuran combined with anthracene host with deuterium.
- 17 blue phosphorescent dopant patents have been applied. Ir or Pt metal compounds with pyrazole or imidazole derivatives seem to emit blue.
- LG chem. and Merk applied for patents on florescent dopants such as amine substituted with benzofluorene or benzofuran derivatives.

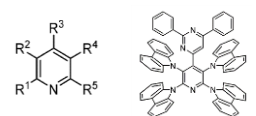
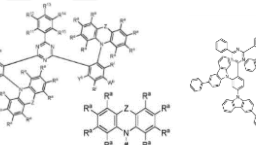
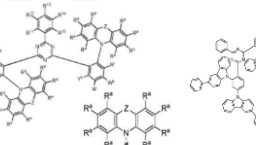
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3. 특허 리뷰

BD_TADF

Boron Core	
CYNORA GMBH US 16/787558 KR 10-2020-0016818 CN 2019-11376742 EP 2020-156089	SAMSUNG DISPLAY KR 2019-01-29 CN2020-10050970 EP 2020-152080
3,5-di-tert-butylphenyl 	Dibenzo azaborinine 
LG Chem KR 10-2020-0017700 PCT-KR2020-002054	SAMSUNG DISPLAY US 16/810626
Silyl 	Dibenzo azaborino ~ 
KWANSEI GAKUIN UNIV JNC CORP KR 10-2020-0017580 CN 2020-10089819	GUANGDONG JUHUA PRINTED DISPLAY TECH CN 2019-10287869
	difluoro, dioxaborin 
KWANSEI GAKUIN UNIV JNC CORP PCT-JP2020-004829	University of Southern California KR 10-2020-0010334 CN 2020-10079135 EP 2020-153982
	triazaborinno1,6-a:3,4-a'diazquinoline 

Pyrimidine Core	
CYNORA GMBH EP 2018-799672	
2-Ph, 4,6-Ph-Cz 	
HUAQIAO University CN 2017-11093178	
diamine 	

Pyridine Core	
KYULUX INC JP 2019-570920	
Triazine Core	
CYNORA GMBH EP 2018-800480	
2-Ph, 4,6-Ph-Cz 	

* Yellow character : Registered

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3. 특허 리뷰

BD_TADF

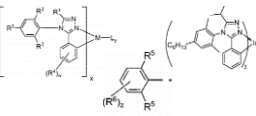
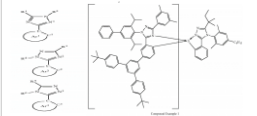
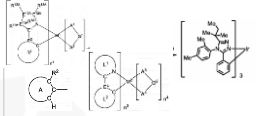
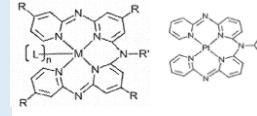
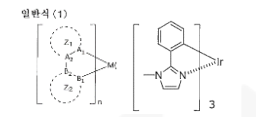
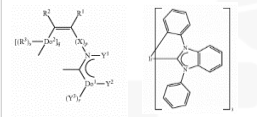
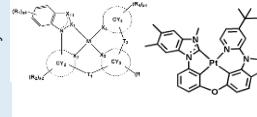

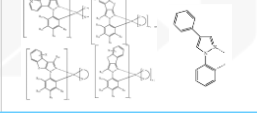
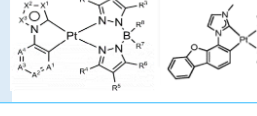
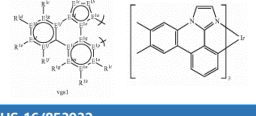
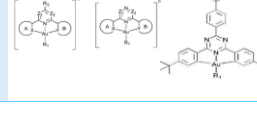
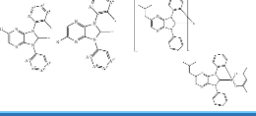
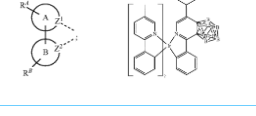
Phenyl Core			
<p>CYNORA GMBH EP 2018-800043</p> <p>Pyridine, Cz, Triazine</p>	<p>KONICA MINOLTA, Inc. KR 10-2017-7029655</p>	<p>GUANGDONG JUHUA PRINTED DISPLAY TECHNOLOGY CN 2019-10342575</p> <p>Benzodiazole</p>	<p>CSOT CN 2018-11378536</p> <p>spiro [acridine-9, 2'-adamantane] 1</p>
<p>CYNORA GMBH EP 2018-799673</p> <p>Fluorophenyl, Cz, Triazine</p>	<p>KYULUX INC JP 2019-570921</p>	<p>Samsung Electronics KR 10-2019-0017964 US 16/587429</p> <p>Benzoimidazole</p>	<p>CSOT US 16/858759</p> <p>Pyridoacridine</p>
<p>CYNORA GMBH EP 2018-782641</p> <p>Benzonitril-Cz, pyrimidine, Cz</p>	<p>IDEMITSU KOSAN EP 2016-772422</p> <p>1-Cz, 6-Triazine</p>	<p>SAMSUNG DISPLAY US 15/839740</p> <p>Cz, Ph-Cz</p>	<p>CSOT CN 2019-10098498</p> <p>Phnoxazine, acridine</p>
<p>CYNORA GMBH EP 10-2017-7022436</p> <p>1,3-EDG, 6-EWG</p>	<p>Merk EP 2018-165596</p>	<p>SAMSUNG DISPLAY KR 10-2019-0015192 CN 2019-11264753 US 16/678508</p>	
<p>CYNORA GMBH EP 2018-793179</p> <p>2,4-Pyrimidine, 3-Cz, 6-CN</p>			

* Yellow character : Registered

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3. 특허 리뷰

BD_PH

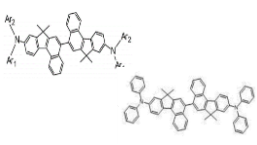
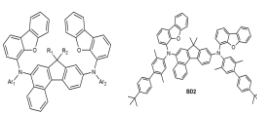
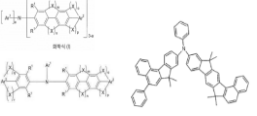
Ir Complex		Pt complex	
<p>CDT [Sumitomo Chem.] EP 2016-723482</p> <p>Triazole-Ar</p> 	<p>CDT [Sumitomo Chem.] US 2016-723482</p> 	<p>Sumitomo Chem. EP 2018-860343</p> 	<p>R-Display & Lighting KR 10-2020-7019379</p> <p>(bis(aziryl)amine</p> 
<p>TOSOH CORP KR 10-2018-7017959</p> <p>Phnylimidazole</p> <p>일반식 (1)</p> 	<p>UDC US 16/798526</p> 		<p>SAMSUNG ELECTRONICS KR 10-2020-0008761 CN 2020-10078240 EP 2020-153874</p> <p>Benzimidazole-HetCy</p> 
<p>LG Display KR 10-2012-0118640</p> <p>Phnylpyrazole</p> <p>Synthetic process</p> 	<p>The University of Southern California US 15/444592</p> 		<p>TECHNISCHE UNIVERSITÄT DRESDEN PCT-EP2020-054656</p> <p>Pyrazole borane</p> 
<p>UDC US 16/511090</p> <p>Imidazo[1,2-f]phenanthridine</p> 			<p>THE UNIVERSITY OF HONG KONG CN 2019-80007327</p> <p>Au complex</p> 
<p>UDC US 16/853032</p> <p>Imidazo pyrazine</p> 			
<p>UDC US 15/915385</p> <p>carborane</p> 			

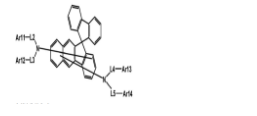
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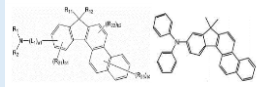
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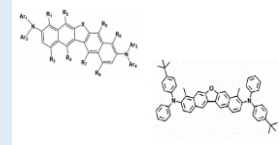
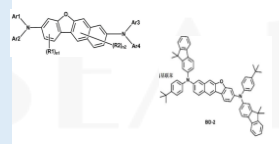
3. 특허 리뷰

BD_FL

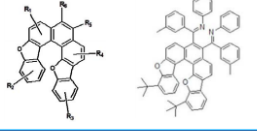
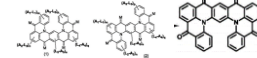
Benzofluorene	
JILIN OPTICAL AND ELECTRONIC MATERIALS	CN 2017-11444628
Diamine	
LG chem	KR 10-2019-0009487
phenylbenzofluorene amine	
Merk	KR 10-2015-7008598
Amine	

Spirobenzofluorene	
LG chem	CN 2019-80006388
Diamine	

Indeno phenanthrene	
SAMSUNG DISPLAY	KR 10-2013-0070487
Amine	

Naphthobenzofuran	
LG chem	KR 10-2020-0011756 PCT-KR2020-001480
Diamine	
LG chem	KR 2019-80007580
Diamine	

Fluorenobenzofuran	
Merk	EP 2018-788736
Amine	

etc.	
NANJING TOPTO MATERIALS	CN 2016-09-30
	
SUZHOU JIUXIAN NEW MATERIAL	CN 2020-10537258
quinoxaline-3,2,1-dejacriline-5,9-dione	

* Yellow character : Registered

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3. 특허 리뷰

Combination

Boron		BH+BD		Ar, Hetaryl-diamine		2 stack blue, BD+BD	
KWANSEI GAKUIN UNIV JNC CORP	KR 10-2020-0011039	Samsung Display	EP 2019-163558	Samsung Display	CN 2020-10307116	KWANSEI GAKUIN UNIV JNC CORP	JP 2020-012206
Anthracene				Anthracene		Dibenzofluorene, Pyrene, Cycene	
KWANSEI GAKUIN UNIV JNC CORP	US 16/617296					BD+BD	5Cz1CN
Anthracene						LG chem	KR 10-2016-0122411
Phenylanthracene						PH dopant	
e-dibenaofuran						BD+aETL	~fluoreno benzofuran
SFC	KR 10-2019-0091889					SFC	US 15/746233
D substituted Ar-anthracene-e-dibenaofuran						benzoquinazolin e, triazine, anthracene	
Samsung Display	JP 2019-067275						
n-host + p-host							

* Yellow character : Registered



Analyst
Dae Jeong YOON