

## SEARCH RECORD

<b>Title of invention: P-I-N PHOTODETECTOR</b>		
<b>Application No:</b> PCT/FI2019/050849		
<b>Priority application No:</b>		
<b>Priority number</b>	<b>Date</b>	<b>Country</b>
1819524.8	30.11.2018	GB

<b>Minimum documentation searched (classification system followed by classification):</b>
IPC, CPC: H01L

<b>Documentation searched other than minimum (FI,SE,NO,DK):</b>
IPC: H01L31/105, H01L31/0224, H01L31/112, H01L51/42, H01L51/44, H01L27/144

<b>Electronic data bases consulted during the novelty search:</b>
EPODOC, EPO-Internal full-text databases, Full-text translation databases from Asian languages, WPIAP, XP3GPP, XPAIP, XPESP, XPETSI, XPI3E, XPIEE, XPIETF, XPIOP, XPIPCOM, XPJPEG, XPMISC, XPOAC, XPRD, XPTK, BIOSIS, COMPDX, EMBASE, INSPEC, MEDLINE, TDB, NPL

<b>Language(s) in which the search was carried out:</b>
English

<b>Examiners consulted:</b>
Verifying examiner Esa Tiiliharju

Date	Examiner
04.02.2020	Teppo Häyrynen

**The listing of the search history:**

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? ..SetDossier PCTFI2019050849 P-I-N PHOTODETECTOR
? ..FI $ABSTRACT
? /PA EMBERION
** SS 1: Results 77
? 1 AND P_I_N
** SS 2: Results 0
? 1 AND INTRINSIC+
** SS 3: Results 0
? 1 AND AMBIPOLAR+
** SS 4: Results 4
? 1 AND UNIPOLAR+
** SS 5: Results 0
? 1 AND PHOTO_TRANSISTOR+
** SS 6: Results 1
? ..v
? 1 AND (OR PHOTO_DETECTOR+, PHOTO_SENSOR+)
** SS 7: Results 21
? 1 AND GRAPHENE+
** SS 8: Results 21
? /PN US8803128
** SS 9: Results 2
? ..v
? /PN WO2019068814
** SS 10: Results 2
? ..v
? /PN WO2019020871
** SS 11: Results 2
? ..v
? /PN WO2019020869
** SS 12: Results 2
? ..v
? /IN (BESSONOV 1D ALEXANDER)
** SS 13: Results 80
? /IN (BESSONOV 1W ALEXANDER)
** SS 14: Results 76
? /IN (ALLEN 1D MARK)
** SS 15: Results 3.638
? 13 AND 15
** SS 16: Results 22
? 15 AND (OR PHOTO_DETECTOR+, PHOTO_SENSOR+)
** SS 17: Results 20
? P_I_N_PHOTO_DETECTOR+
** SS 18: Results 192
? 18 AND (OR TWO_DIMENSIONAL_MATERIAL+, 2D_MATERIAL+)
** SS 19: Results 0
? 18 AND (GRAPHENE+)
** SS 20: Results 1
? 18 AND CHARGE_ACCUMUL+
** SS 21: Results 0
? 18 AND VOLTAGE_MODE+
** SS 22: Results 0
? 18 AND PHOTO_TRANSISTOR+
** SS 23: Results 1
? 18 AND PHOTO_ACTIVE+
** SS 24: Results 0
? 18 AND AMBI_POLAR+
** SS 25: Results 0
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? 18 AND UNI\_POLAR+  
\*\* SS 26: Results 0  
? 18 AND INTRINSIC+  
\*\* SS 27: Results 58  
? /PN US5567971  
\*\* SS 28: Results 2  
? /PN US2016035794  
\*\* SS 29: Results 2  
? ..v  
? /PN EP3144980  
\*\* SS 30: Results 2  
? ..v  
? /PN US20160359062  
\*\* SS 31: Results 0  
? /PN US2016359062  
\*\* SS 32: Results 2  
? ..v  
? PN PCTFI20176109  
\*\* SS 33: Results 0  
? PN PCT20176109  
\*\* SS 34: Results 0  
? PN FI20176109  
\*\* SS 35: Results 0  
? LOGON  
? ..FI \$ABSTRACT  
? (AND H01L51/42/C/IC/LOW, H01L31/105/C/IC/LOW, H01L31/0224/C/IC/LOW, H01L51/44/C/IC/LOW, H01L27/144/C/IC/LOW, H01L31/112/C/IC/LOW)  
\*\* SS 1: Results 0  
? (OR H01L51/42/C/IC/LOW, H01L31/105/C/IC/LOW, H01L31/0224/C/IC/LOW, H01L51/44/C/IC/LOW, H01L27/144/C/IC/LOW, H01L31/112/C/IC/LOW)  
\*\* SS 2: Results 286.130  
? (OR H01L51/42/C/IC/LOW, H01L31/105/C/IC/LOW, H01L31/0224/C/IC/LOW, H01L51/44/C/IC/LOW, H01L27/144/C/IC/LOW, H01L31/112/C/IC/LOW) AND PHOTO\_ACTIVE+  
\*\* SS 3: Results 3.083  
? (OR H01L51/42/C/IC/LOW, H01L31/105/C/IC/LOW, H01L31/0224/C/IC/LOW, H01L51/44/C/IC/LOW, H01L27/144/C/IC/LOW, H01L31/112/C/IC/LOW) AND (AND PHOTO\_ACTIVE+, HETERO\_JUNCTION+)  
\*\* SS 4: Results 332  
? (OR H01L51/42/C/IC/LOW, H01L31/105/C/IC/LOW, H01L31/0224/C/IC/LOW, H01L51/44/C/IC/LOW, H01L27/144/C/IC/LOW, H01L31/112/C/IC/LOW) AND (AND PHOTO\_ACTIVE+, HETERO\_JUNCTION+, P\_I\_N)  
\*\* SS 5: Results 1  
? (OR H01L51/42/C/IC/LOW, H01L31/105/C/IC/LOW, H01L31/0224/C/IC/LOW, H01L51/44/C/IC/LOW, H01L27/144/C/IC/LOW, H01L31/112/C/IC/LOW) AND (P\_I\_N)  
\*\* SS 6: Results 3.171  
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\*\* SS 7: Results 492  
? (OR H01L51/42/C/IC/LOW, H01L31/105/C/IC/LOW, H01L31/0224/C/IC/LOW, H01L51/44/C/IC/LOW, H01L27/144/C/IC/LOW, H01L31/112/C/IC/LOW) AND (AND P\_I\_N, (OR PHOTO\_DETECTOR+, PHOTO\_SENSOR+), GRAPHENE+)  
\*\* SS 8: Results 5  
? (OR H01L51/42/C/IC/LOW, H01L31/105/C/IC/LOW, H01L31/0224/C/IC/LOW, H01L51/44/C/IC/LOW, H01L27/144/C/IC/LOW, H01L31/112/C/IC/LOW) AND (AND P\_I\_N, (OR PHOTO\_DETECTOR+, PHOTO\_SENSOR+), TWO\_DIMENSIONAL\_MATERIAL+)  
\*\* SS 9: Results 0  
? (OR H01L51/42/C/IC/LOW, H01L31/105/C/IC/LOW, H01L31/0224/C/IC/LOW, H01L51/44/C/IC/LOW, H01L27/144/C/IC/LOW, H01L31/112/C/IC/LOW) AND (AND P\_I\_N, (OR PHOTO\_DETECTOR+, PHOTO\_SENSOR+), TWO\_DIMENSIONAL+)  
\*\* SS 10: Results 9  
? (OR H01L51/42/C/IC/LOW, H01L31/105/C/IC/LOW, H01L31/0224/C/IC/LOW, H01L51/44/C/IC/LOW,

H01L27/144/C/IC/LOW, H01L31/112/C/IC/LOW) AND (AND P\_I\_N, (OR PHOTO\_DETECTOR+, PHOTO\_SENSOR+), 2D\_MATERIAL+)

\*\* SS 11: Results 0  
? (OR H01L51/42/C/IC/LOW, H01L31/105/C/IC/LOW, H01L31/0224/C/IC/LOW, H01L51/44/C/IC/LOW, H01L27/144/C/IC/LOW, H01L31/112/C/IC/LOW) AND (AND P\_I\_N, (OR PHOTO\_DETECTOR+, PHOTO\_SENSOR+), PHOTO\_ACTIVE+)

\*\* SS 12: Results 6  
? (OR H01L51/42/C/IC/LOW, H01L31/105/C/IC/LOW, H01L31/0224/C/IC/LOW, H01L51/44/C/IC/LOW, H01L27/144/C/IC/LOW, H01L31/112/C/IC/LOW) AND (AND P\_I\_N, (OR PHOTO\_DETECTOR+, PHOTO\_SENSOR+), NANO\_CRYSTAL+)

\*\* SS 13: Results 1  
? (OR H01L51/42/C/IC/LOW, H01L31/105/C/IC/LOW, H01L31/0224/C/IC/LOW, H01L51/44/C/IC/LOW, H01L27/144/C/IC/LOW, H01L31/112/C/IC/LOW) AND (AND P\_I\_N, (OR PHOTO\_DETECTOR+, PHOTO\_SENSOR+), NANO\_PARTICLE+)

\*\* SS 14: Results 3  
? (OR H01L51/42/C/IC/LOW, H01L31/105/C/IC/LOW, H01L31/0224/C/IC/LOW, H01L51/44/C/IC/LOW, H01L27/144/C/IC/LOW, H01L31/112/C/IC/LOW) AND (AND P\_I\_N, PHOTO\_TRANSISTOR+)

\*\* SS 15: Results 24  
? (OR H01L51/42/C/IC/LOW, H01L31/105/C/IC/LOW, H01L31/0224/C/IC/LOW, H01L51/44/C/IC/LOW, H01L27/144/C/IC/LOW, H01L31/112/C/IC/LOW) AND (AND PHOTO\_ACTIVE+, HETERO\_JUNCTION+, PHOTO\_TRANSISTOR+)

\*\* SS 16: Results 2  
? (OR H01L51/42/C/IC/LOW, H01L31/105/C/IC/LOW, H01L31/0224/C/IC/LOW, H01L51/44/C/IC/LOW, H01L27/144/C/IC/LOW, H01L31/112/C/IC/LOW) AND (AND PHOTO\_ACTIVE+, HETERO\_JUNCTION+, NANO\_CRYSTAL+)

\*\* SS 17: Results 7  
? (OR H01L51/42/C/IC/LOW, H01L31/105/C/IC/LOW, H01L31/0224/C/IC/LOW, H01L51/44/C/IC/LOW, H01L27/144/C/IC/LOW, H01L31/112/C/IC/LOW) AND (AND PHOTO\_ACTIVE+, HETERO\_JUNCTION+, NANO\_PARTICLE+)

\*\* SS 18: Results 15  
? P\_I\_N\_PHOTO\_DETECTOR+ OR P\_I\_N\_PHOTO\_SENSOR+

\*\* SS 19: Results 198  
? (OR H01L51/C/IC/LOW, H01L31/C/IC/LOW, H01L27/C/IC/LOW) AND (5UG (OR STACK, MULTI+, SEVERAL), PHOTO\_ACTIVE+, LAYER+)

\*\* SS 20: Results 55  
? (OR H01L51/C/IC/LOW, H01L31/C/IC/LOW, H01L27/C/IC/LOW) AND (P\_I\_N\_PHOTO\_DETECTOR+ OR P\_I\_N\_PHOTO\_SENSOR+)

\*\* SS 21: Results 134  
? (OR H01L51/C/IC/LOW, H01L31/C/IC/LOW, H01L27/C/IC/LOW) AND (P\_I\_N\_PHOTO\_DETECTOR+ OR P\_I\_N\_PHOTO\_SENSOR+) AND (INFRA\_RED+)

\*\* SS 22: Results 8  
? (OR H01L51/C/IC/LOW, H01L31/C/IC/LOW, H01L27/C/IC/LOW) AND (P\_I\_NTO\_SENSOR+)

\*\* SS 23: Results 0  
? (OR H01L51/C/IC/LOW, H01L31/C/IC/LOW, H01L27/C/IC/LOW) AND (P\_I\_N\_DETECTOR+ OR P\_I\_N\_SENSOR+)

\*\* SS 24: Results 80  
? (OR H01L51/C/IC/LOW, H01L31/C/IC/LOW, H01L27/C/IC/LOW) AND (P\_I\_N\_PHOTO\_DETECTOR+ OR P\_I\_N\_PHOTO\_SENSOR+) AND (OR NANO\_CRYSTAL+, NANO\_PARTICLE+, QUANTUM\_DOT+)

\*\* SS 25: Results 0  
? (OR H01L51/C/IC/LOW, H01L31/C/IC/LOW, H01L27/C/IC/LOW) AND (P\_I\_N\_PHOTO\_DETECTOR+ OR P\_I\_N\_PHOTO\_SENSOR+) AND (GRAPHENE+)

\*\* SS 26: Results 1  
? ..v  
? (OR H01L51/C/IC/LOW, H01L31/C/IC/LOW, H01L27/C/IC/LOW) AND (P\_I\_N\_PHOTO\_DETECTOR+ OR P\_I\_N\_PHOTO\_SENSOR+) AND (CHARGE\_ACCUM+)

\*\* SS 27: Results 0  
? (OR H01L51/C/IC/LOW, H01L31/C/IC/LOW, H01L27/C/IC/LOW) AND (P\_I\_N\_PHOTO\_DETECTOR+ OR P\_I\_N\_PHOTO\_SENSOR+) AND (OR TWO\_DIMENSIONAL+, 2D\_MATERIAL+)

\*\* SS 28: Results 2  
? P\_I\_N\_PHOTO\_DETECTOR+

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** SS 29: Results 192
? P_I_N_DETECTOR+
** SS 30: Results 350
? P_I_N_PHOTO_SENSOR+
** SS 31: Results 8
? P_I_N_SENSOR+
** SS 32: Results 383
? (OR H01L51/C/IC/LOW, H01L31/C/IC/LOW, H01L27/C/IC/LOW) AND (P_I_N_PHOTO_DETECTOR+ OR
P_I_N_PHOTO_SENSOR+)
** SS 33: Results 134
? (OR H01L51/C/IC/LOW, H01L31/C/IC/LOW, H01L27/C/IC/LOW) AND (P_I_N_DETECTOR+ OR
P_I_N_SENSOR+)
** SS 34: Results 80
? (OR P_I_N_PHOTO_DETECTOR+, P_I_N_PHOTO_SENSOR+, P_I_N_DETECTOR+, P_I_N_SENSOR+)
** SS 35: Results 926
? 35 AND (OR NANO_CRYSTAL+, NANO_PARTICLE+, QUANTUM_DOT+)
** SS 36: Results 1
? 35 AND (CRYSTALLINE_CHANNEL+)
** SS 37: Results 0
? 35 AND (AMORPHOUS_CHANNEL+)
** SS 38: Results 0
? 35 AND (PHOTO_ACTIVE_LAYER+)
** SS 39: Results 0
? 35 AND (TRANSISTOR+)
** SS 40: Results 26
? 35 AND (VOLTAGE_MODE+)
** SS 41: Results 0
? 35 AND CHARGE_ACCUM+
** SS 42: Results 0
? P_I_N_ABSORBER+
** SS 43: Results 1
? P_I_N_CHANNEL+
** SS 44: Results 669
? P_I_N_CHANNEL+ AND PHOTO_TRANSISTOR+
** SS 45: Results 0
? P_I_N_CHANNEL+ AND VOLTAGE_MODE+
** SS 46: Results 0
? P_I_N_CHANNEL+ AND (OR DETECTOR+, SENSOR+)
** SS 47: Results 18
? P_I_N_CHANNEL+ AND (OR PHOTO_DETECTOR+, PHOTO_SENSOR+)
** SS 48: Results 0
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** SS 49: Results 78
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** SS 1: Results 58.004
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** SS 2: Results 40
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** SS 3: Results 140
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? \*2 AND NO/PN {All NO documents}  
 \*\* SS 4: Results 23  
 ? \*3 AND FI/PN {All FI documents}  
 \*\* SS 5: Results 11  
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 \*\* SS 6: Results 214  
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 \*\* SS 8: Results 57  
 ? \* AND SE/PN {Filtered SE documents}  
 \*\* SS 9: Results 1  
 ? \*1 AND DK/PN {Filtered DK documents}  
 \*\* SS 10: Results 54  
 ? \*2 AND NO/PN {Filtered NO documents}  
 \*\* SS 11: Results 2  
 ? \*3 AND FI/PN {Filtered FI documents}  
 \*\* SS 12: Results 0

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? XFull Fulltext Patent Search:

Mode Direct (Patent Search)

English query concept 1: 'or p\_i\_n\_photo\_detector+, p\_i\_n\_photo\_sensor+, p\_i\_n\_detector+, p\_i\_n\_sensor+'

concept 2: 'or nano\_crystal+, nano\_particle+, quantum\_dot+'

concept 3: 'or p\_i\_n\_hetero\_junction+, p\_i\_n\_channel+, p\_i\_n\_absorber+'

concept 4: 'or two\_dimensional\_material+, 2D\_material+, graphene+'

concept 5: 'or charge\_accumul+, voltage\_mode+'

concept 6: 'photo\_transistor+'

concept 7: 'or photo\_active\_layer+, measurement\_layer+, intrinsic\_semiconduct+\_layer+'

concept 8: 'or ambipolar+, unipolar+'

concept 9: 'or crystalline\_channel+, amorphous\_channel+'

English cluster: 'TCM TXPCNEA TXPCNEB TXPCNEC TXPCNEU TXPCNEY TXPEA TXPEB TXPEC TXPEE TXPEF TXPEH TXPEI TXPEP TXPEPEA TXPEPEB TXPEF TXPEU TXPEY TXPJPEA TXPJPEB TXPJPOEA TXPJPOEB TXPKREA TXPKREB TXPKREU TXPKREY TXPMTCEA TXPMTCEB TXPMTCEU TXPMTEA TXPMTEB TXPMTEC TXPMTEE TXPMTET TXPMTEU TXPMTEW TXPMTEY TXPMTEZ TXPMTJEA TXPMTJEB TXPMTJEU TXPMTJEY TXPMTKEA TXPMTKEB TXPMTKEU TXPMTKEY TXPSPJEA TXPSPJEB TXPSPJEU TXPSPJEY TXPSPKEA TXPSPKEB TXPSPKEU TXPSPKEY TXPSPWEA TXPUSE0A TXPUSE1A TXPUSEA TXPUSEB TXPW0EA TXPW0EA WPIAP EPODOC'

English limit: None

English results: 0

German query concept 1: ''

concept 2: ''

concept 3: ''

concept 4: ''

concept 5: ''

concept 6: ''

concept 7: ''

concept 8: ''

concept 9: ''

German cluster: ''

German limit: None

German results: 0

French query concept 1: ''

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concept 3: ''  
concept 4: ''  
concept 5: ''  
concept 6: ''  
concept 7: ''  
concept 8: ''  
concept 9: ''  
French cluster: ''  
French limit: None  
French results: 0  
? XFull Fulltext Patent Search:  
Mode Direct (Patent Search)  
English query concept 1: 'or p\_i\_n\_photo\_detector+, p\_i\_n\_photo\_sensor+, p\_i\_n\_detector+, p\_i\_n\_sensor+'  
concept 2: 'or nano\_crystal+, nano\_particle+, quantum\_dot+'  
concept 3: 'or p\_i\_n\_hetero\_junction+, p\_i\_n\_channel+, p\_i\_n\_absorber+'  
concept 4: 'or two\_dimensional\_material+, 2D\_material+, graphene+'  
concept 5: 'or charge\_accumul+, voltage\_mode+'  
concept 6: 'photo\_transistor+'  
concept 7: 'or photo\_active\_layer+, measurement\_layer+, intrinsic\_semiconduct+\_layer+'  
concept 8: 'or ambipolar+, unipolar+'  
concept 9: 'or crystalline\_channel+, amorphous\_channel+'  
English cluster: 'TCM TXPCNEA TXPCNEB TXPCNEC TXPCNEU TXPCNEY TXPEA TXPEB TXPEC TXPEE TXPEF TXPEH TXPEI TXPEP TXPEPEA TXPEPEB TXPES TXPEU TXPEY TXPJPEA TXPJPEB TXPJPOEA TXPJPOEB TXPKREA TXPKREB TXPKREU TXPKREY TXPMTCEA TXPMTCEB TXPMTCEU TXPMTEA TXPMTEB TXPMTEC TXPMTEE TXPMTET TXPMTEU TXPMTEW TXPMTEY TXPMTJEA TXPMTJEB TXPMTJEU TXPMTJEY TXPMTKEA TXPMTKEB TXPMTKEU TXPMTKEY TXPSPJEA TXPSPJEB TXPSPJEU TXPSPJEY TXPSPKEA TXPSPKEB TXPSPKEU TXPSPKEY TXPSPWEA TXPUSE0A TXPUSE1A TXPUSEA TXPUSEB TXPW0EA TXPW0EA WPIAP EPODOC'  
English limit: None  
English results: 0  
German query concept 1: ''  
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concept 6: ''  
concept 7: ''  
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German cluster: ''  
German limit: None  
German results: 0  
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concept 7: ''  
concept 8: ''  
concept 9: ''  
French cluster: ''  
French limit: None  
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? XFull Fulltext Patent Search:  
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English query concept 1: 'or p\_i\_n\_photo\_detector+, p\_i\_n\_photo\_sensor+, p\_i\_n\_detector+, p\_i\_n\_sensor+'

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English cluster: 'TCM TXPCNEA TXPCNEB TXPCNEC TXPCNEU TXPCNEY TXPEA TXPEB TXPEC TXPEE  
TXPEF TXPEH TXPEI TXPEP TXPEPEA TXPEPEB TXPES TXPEU TXPEY TXPJPEA TXPJPEB TXPJPOEA  
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WPIAP EPODOC'  
English limit: None  
English results: 0  
German query concept 1: ''  
concept 2: ''  
concept 3: ''  
concept 4: ''  
concept 5: ''  
concept 6: ''  
concept 7: ''  
concept 8: ''  
concept 9: ''  
German cluster: ''  
German limit: None  
German results: 0  
French query concept 1: ''  
concept 2: ''  
concept 3: ''  
concept 4: ''  
concept 5: ''  
concept 6: ''  
concept 7: ''  
concept 8: ''  
concept 9: ''  
French cluster: ''  
French limit: None  
French results: 0  
? XFull Fulltext Patent Search:  
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concept 6: 'photo\_transistor+'  
concept 7: 'or photo\_active\_layer+, measurement\_layer+, intrinsic\_semiconduct+\_layer+'  
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concept 9: 'or crystalline\_channel+, amorphous\_channel+'  
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TXPEF TXPEH TXPEI TXPEP TXPEPEA TXPEPEB TXPES TXPEU TXPEY TXPJPEA TXPJPEB TXPJPOEA  
TXPJPOEB TXPKREA TXPKREB TXPKREU TXPKREY TXPMTCEA TXPMTCEB TXPMTCEU TXPMTEA TXPMTEB  
TXPMTEC TXPMTEE TXPMTET TXPMTEU TXPMTEW TXPMTEY TXPMTEZ TXPMTJEA TXPMTJEB TXPMTJEU  
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WPIAP EPODOC'







concept 2: 'or nano\_crystal+, nano\_particle+, quantum\_dot+'  
concept 3: 'or p\_i\_n\_hetero\_junction+, p\_i\_n\_channel+, p\_i\_n\_absorber+'  
concept 4: 'or two\_dimensional\_material+, 2D\_material+, graphene+'  
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concept 9: 'or crystalline\_channel+, amorphous\_channel+'  
English cluster: 'TCM TXPCNEA TXPCNEB TXPCNEC TXPCNEU TXPCNEY TXPEA TXPEB TXPEC TXPEE  
TXPEF TXPEH TXPEI TXPEP TXPEPEA TXPEPEB TXPES TXPEU TXPEY TXPJPEA TXPJPEB TXPJPOEA  
TXPJPOEB TXPKREA TXPKREB TXPKREU TXPKREY TXPMTCEA TXPMTCEB TXPMTCEU TXPMTEA TXPMTEB  
TXPMTEC TXPMTEE TXPMTET TXPMTEU TXPMTEW TXPMTEY TXPMTEZ TXPMTJEA TXPMTJEB TXPMTJEU  
TXPMTJEY TXPMTKEA TXPMTKEB TXPMTKEU TXPMTKEY TXPSPJEA TXPSPJEB TXPSPJEU TXPSPJEY TXPSPKEA  
TXPSPKEB TXPSPKEU TXPSPKEY TXPSPWEA TXPUSE0A TXPUSE1A TXPUSEA TXPUSEB TXPW0EA TXPW0EA  
WPIAP EPODOC'  
English limit: None  
English results: 0  
German query concept 1: ''  
concept 2: ''  
concept 3: ''  
concept 4: ''  
concept 5: ''  
concept 6: ''  
concept 7: ''  
concept 8: ''  
concept 9: ''  
German cluster: ''  
German limit: None  
German results: 0  
French query concept 1: ''  
concept 2: ''  
concept 3: ''  
concept 4: ''  
concept 5: ''  
concept 6: ''  
concept 7: ''  
concept 8: ''  
concept 9: ''  
French cluster: ''  
French limit: None  
French results: 0  
? XFull Fulltext Patent Search:  
Mode Direct (Patent Search)  
English query concept 1: 'or p\_i\_n\_photo\_detector+, p\_i\_n\_photo\_sensor+, p\_i\_n\_detector+,  
p\_i\_n\_sensor+'  
concept 2: 'or nano\_crystal+, nano\_particle+, quantum\_dot+'  
concept 3: 'or p\_i\_n\_hetero\_junction+, p\_i\_n\_channel+, p\_i\_n\_absorber+'  
concept 4: 'or two\_dimensional\_material+, 2D\_material+, graphene+'  
concept 5: 'or charge\_accumul+, voltage\_mode+'  
concept 6: 'photo\_transistor+'  
concept 7: 'or photo\_active\_layer+, measurement\_layer+, intrinsic\_semiconduct+\_layer+'  
concept 8: 'or ambipolar+, unipolar+'  
concept 9: 'or crystalline\_channel+, amorphous\_channel+'  
English cluster: 'TCM TXPCNEA TXPCNEB TXPCNEC TXPCNEU TXPCNEY TXPEA TXPEB TXPEC TXPEE  
TXPEF TXPEH TXPEI TXPEP TXPEPEA TXPEPEB TXPES TXPEU TXPEY TXPJPEA TXPJPEB TXPJPOEA  
TXPJPOEB TXPKREA TXPKREB TXPKREU TXPKREY TXPMTCEA TXPMTCEB TXPMTCEU TXPMTEA TXPMTEB  
TXPMTEC TXPMTEE TXPMTET TXPMTEU TXPMTEW TXPMTEY TXPMTEZ TXPMTJEA TXPMTJEB TXPMTJEU  
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TXPSPKEB TXPSPKEU TXPSPKEY TXPSPWEA TXPUSE0A TXPUSE1A TXPUSEA TXPUSEB TXPW0EA TXPW0EA  
WPIAP EPODOC'





concept 2: 'or nano\_crystal+, nano\_particle+, quantum\_dot+'  
concept 3: 'or p\_i\_n\_hetero\_junction+, p\_i\_n\_channel+, p\_i\_n\_absorber+'  
concept 4: 'or two\_dimensional\_material+, 2D\_material+, graphene+'  
concept 5: 'or charge\_accumul+, voltage\_mode+'  
concept 6: 'photo\_transistor+'  
concept 7: 'or photo\_active\_layer+, measurement\_layer+, intrinsic\_semiconduct+\_layer+'  
concept 8: 'or ambipolar+, unipolar+'  
concept 9: 'or crystalline\_channel+, amorphous\_channel+'  
English cluster: 'XP3GPP XPAIP XPCPVO XPESP XPETSI XPI3E XPIEE XPIETF XPIOF XPIPCOM XPJPEG  
XPMISC XPOAC XPRD XPTK' 'BIOSIS COMPDX EMBASE INSPEC MEDLINE TDB' ''  
English limit: None  
English results: 0

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Input for Combi:

"US5567971"/PN

16 PN Documents found

4 NPL Documents found

including 4 large family members

Input for Combi:

"US2016035794"/PN

5 PN Documents found

0 NPL Documents found

including 2 large family members

Input for Combi:

"EP3144980"/PN

53 PN Documents found

0 NPL Documents found

including 4 large family members

Input for Combi:

"US2016359062"/PN

30 PN Documents found

0 NPL Documents found

including 2 large family members

Input for Combi:

"GB2572192"/PN

11 PN Documents found

3 NPL Documents found

including 3 large family members

Input for Combi:

"CN103383976B"/PN

7 PN Documents found

0 NPL Documents found

including 1 large family members

Input for Combi:

"US2006194418"/PN

95 PN Documents found

0 NPL Documents found

including 8 large family members

Input for Combi:

"TW200603426"/PN

0 PN Documents found

0 NPL Documents found

including 1 large family members

Input for Combi:

"US2010321341"/PN

60 PN Documents found

0 NPL Documents found

including 3 large family members

Input for Combi:

"US2014077210"/PN

**SEARCH RECORD****Application No: PCT/FI2019/050849**

3 PN Documents found  
0 NPL Documents found  
including 1 large family members  
Input for Combi:  
"US2009294767"/PN

40 PN Documents found  
0 NPL Documents found  
including 3 large family members  
Input for Combi:  
"US2017133416"/PN

33 PN Documents found  
0 NPL Documents found  
including 5 large family members  
Input for Combi:  
"US2013292685"/PN

36 PN Documents found  
0 NPL Documents found  
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Input for Combi:  
"US2018158934"/PN

16 PN Documents found  
0 NPL Documents found  
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Input for Combi:  
"WO2013017605"/PN

103 PN Documents found  
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including 7 large family members  
Input for Combi:  
"EP3206235"/PN

37 PN Documents found  
0 NPL Documents found  
including 2 large family members  
Input for Combi:  
"EP3136445"/PN

23 PN Documents found  
0 NPL Documents found  
including 6 large family members  
Input for Combi:  
"US2007057144"/PN

26 PN Documents found  
0 NPL Documents found  
including 2 large family members

**Other Information:**