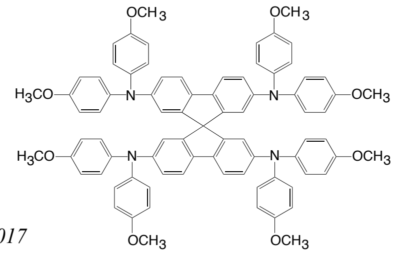
Hole Transport Materials

Recently, organic–inorganic lead halide perovskite solar cell receives increasing attention as a cutting-edge photovoltaic technology owing to its low production cost, straightforward fabrication and high power conversion efficiency. So far, with the great efforts of researchers worldwide, perovskite solar cell had undergone expeditious development with the power conversion efficiency astonishing increased from 3% to 23%. Typically, the highly efficient perovskite solar cell possess a well layer-by-layer structure with the perovskite light harvesting material sandwiched between electron and hole transport materials. The hole transport materials are found playing a crucial role in hole extraction and transport, and reducing the energy barrier between the perovskite and electrode[5], the following hole transport materials are selected from open publications for your suggestions and validations only.

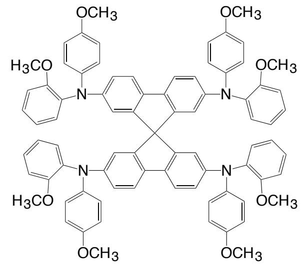
[5] *Journal of Energy Chemistry, 43, 98–103 (2020)*

LT-S922 Spiro-MeOTAD



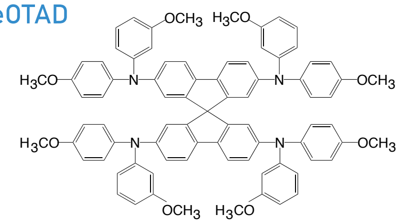
HOMO：-5.00 eV
LUMO：-2.05 eV
PCE：18.82%
Appl. Mater. Interfaces,9, 11828,2017

LT-S9146 p,o-Spiro-MeOTAD



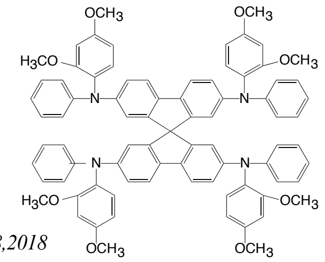
HOMO：-5.22 eV
LUMO：-2.18 eV
PCE：16.7%
J. Am. Chem. Soc,136, 7837,2014

LT-S9145 p,m-Spiro-MeOTAD



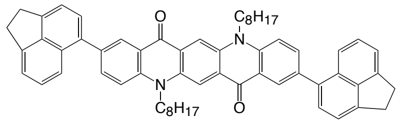
HOMO：-5.31 eV
LUMO：-2.31 eV
PCE：13.9%
J. Am. Chem. Soc,136, 7837,2014

LT-S9437 2,4-Spiro-MeOTAD



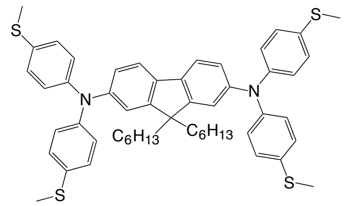
HOMO：-5.24 eV
LUMO：-2.08 eV
PCE：17.2%
Solar Energy Materials and Solar Cells,176, 318,2018

LT-S9484 ACE-QA-ACE



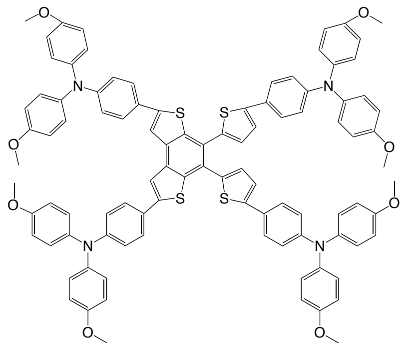
HOMO：-5.59 eV
LUMO：-3.47 eV
PCE：18.2%
J. Mater. Chem. A,7, 5315,2019

LT-S9485 FMT



HOMO：-4.89 eV
LUMO：-1.94. eV
PCE：19.06%
Adv. Funct. Mater,29, 1900484,2019

LT-S9486 TTE-2



HOMO：-5.30 eV
LUMO：-2.68 eV
PCE：20.04%
Angew. Chem. Int. Ed,58,3784,2019

Custom Synthesis

Lumtec offer customize service for non-fullerene organic solar cell and perovskite organic solar cell.(Donor & Acceptor & Interface & Hole Transport & Organic halide salt & Intermediate etc.)

Luminescence Technology Corp.

Materials for non-Fullerene Organic Solar Cell and Perovskite Organic Solar Cell

Significant improvement in the power conversion efficiency (PCE) of organic solar cells (OSCs) is achieved by non-fullerene organic solar cell and perovskite organic solar cell. At present, PCEs exceeding 16% have been achieved in Non-fullerene organic solar cell[1] and PCEs exceeding 23% have been achieved in perovskite organic solar cell[2].

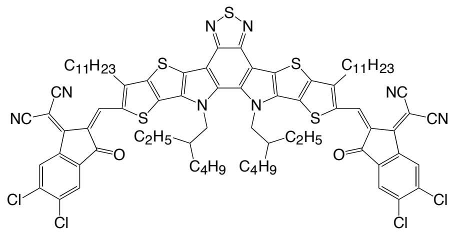
[1] *Nat. Commun, 10, 2515 (2019)* [2] *Nature, 567, 511 (2019)*

None Fullerene Acceptors/Polymeric Acceptors

Non-fullerene organic solar cells (NFOSCs) have attracted tremendous attention in recent years due to the huge amounts of non-fullerene acceptors developed in recent years. Among them, small molecules based on acceptor-donor-acceptor (A-D-A) structures are widely studied with high power conversion efficiencies over 16% in single junction organic solar cells. These electron acceptors contain a fused donating backbone that is beneficial for charge delocalization, bulky aromatic side units to prevent aggregation and facilitate phase separation, and two electron-withdrawing end groups in order to tune frontier energy levels. In addition, the pull-push–pull structure in these acceptors can induce intramolecular charge transfer so as to extend absorption spectrum to near-infrared region. All these merits make them to lead the research of NFOSCs[3], the following none fullerene acceptors and polymeric acceptors are selected from open publications for your suggestions and validations only.

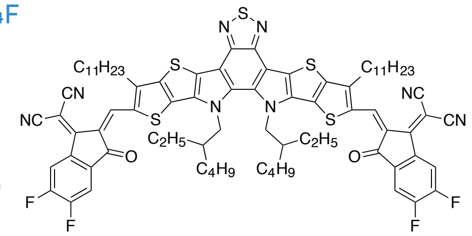
[3] *Chinese Chemical Letters, 30, 222 (2019)*

LT-S9491 Y7,BTP-4Cl



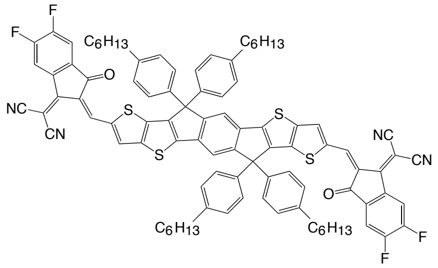
HOMO：-5.68 eV
LUMO：-4.14 eV
PCE：16.5%(with PM6)
Nat. Commun., 10,2515, 2019

LT-S9476 Y6,BTP-4F



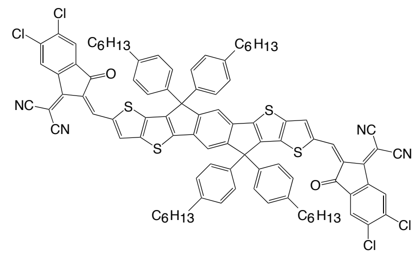
HOMO：-5.65 eV
LUMO：-4.10 eV
PCE：15.7%(with PM6)
Joule 3, 1-12,2019

LT-S9447 IT-4F,ITIC-2F



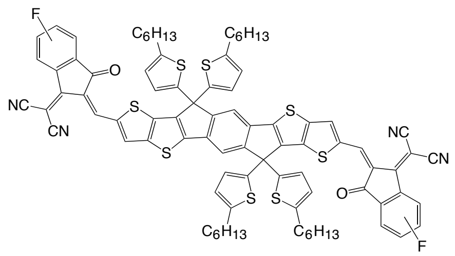
HOMO：-5.69 eV
LUMO：-4.07 eV
PCE：13.5%(with PM6)
Sci China Chem, 61,531,2018

LT-S9494 IT-4Cl,ITIC-2Cl



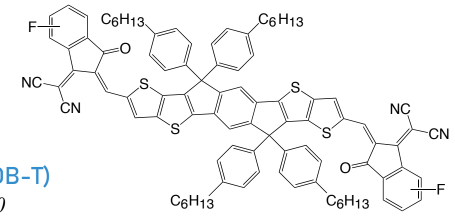
HOMO：-5.75 eV
LUMO：-4.09 eV
PCE：13.45%(with PM6)
Adv. Mater,30, 1800613,2018

LT-S9492 ITIC-Th1



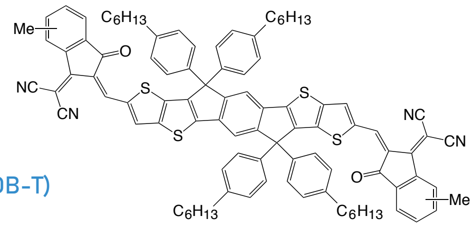
HOMO：-5.74 eV
LUMO：-4.01 eV
PCE：12.1%(with FTAZ)
Adv. Mater,29, 1700144,2017

LT-S9495 IT-2F



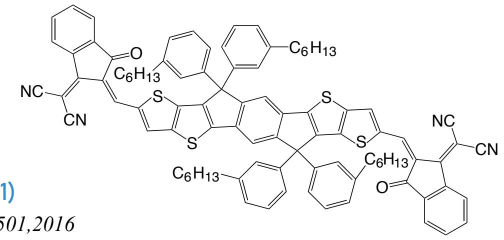
HOMO：-5.41 eV
LUMO：-3.87 eV
PCE：12.08%(with PBDB-T)
Solar Energy,195, 429,2020

LT-S9473 ITIC-M



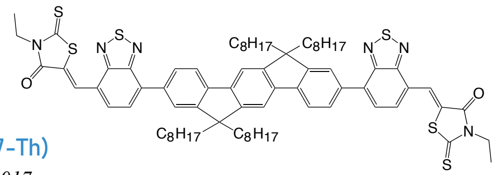
HOMO：-5.58 eV
LUMO：-3.98 eV
PCE：12.05%(with PBDB-T)
Adv. Mater,28, 9423,2016

LT-S9493 m-ITIC



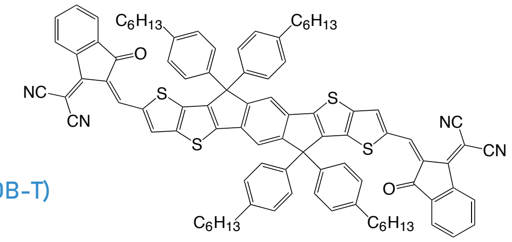
HOMO：-5.52 eV
LUMO：-3.82 eV
PCE：11.77%(with J61)
J. Am. Chem. Soc,138, 1501,2016

LT-S9468 IDFBR



HOMO：-5.75 eV
LUMO：-3.70 eV
PCE：11.0%(with PTB7-Th)
Nature Materials,16, 363,2017

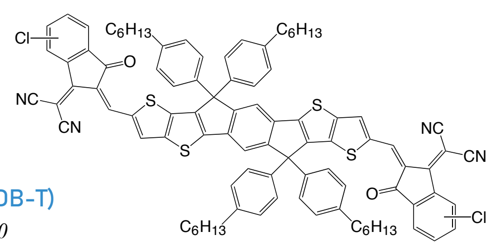
LT-S9212 ITIC



HOMO：-5.51 eV
LUMO：-3.78 eV
PCE：11.21%(with PBDB-T)
Adv. Mater,28, 4734,2016

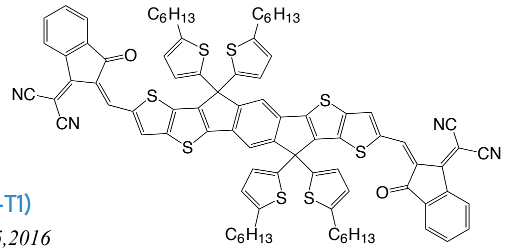
Head office: 31F-5, No. 99, Sec. 1, Xintai 5th Rd., Xizhi, New Taipei City 22175, Taiwan, R.O.C., TEL: +886-2-2697-5600, FAX: +886-2-2697-5601.
Factory I: 2F, No. 17, R&D Road II, Science-Based Industrial Park, Hsin-Chu 30076, Taiwan, R.O.C., TEL: +886-3-666-3188, FAX: +886-3-666-9288.
總公司：22175新北市汐止區新台五路一段99號31樓之5 T 02-2697-5600 F 02-2697-5601.
新竹廠：30076新竹科學工業園區研發二路17號2樓 T 03-666-3188 F 03-666-9288.
E-mail: sales@lumtec.com.tw; Web: www.lumtec.com.tw

LT-S9496 IT-2Cl



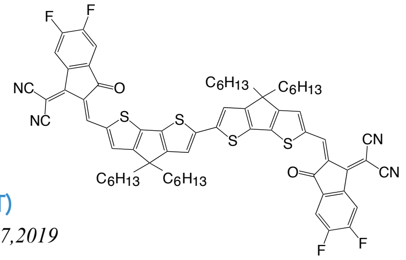
HOMO：-5.42 eV
LUMO：-3.90 eV
PCE：10.77%(with PBDB-T)
Solar Energy,195, 429,2020

LT-S9471 ICIT-Th



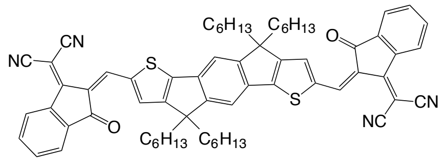
HOMO：-5.66 eV
LUMO：-3.93 eV
PCE：9.6%(with PDBT-T1)
J. Am. Chem. Soc,138, 4955,2016

LT-S9475 CPDT-4F



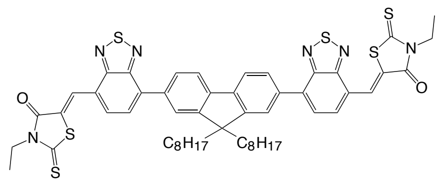
HOMO：-5.26 eV
LUMO：-3.87 eV
PCE：9.29%(with PBDB-T)
Appl. Mater. Interfaces,11, 6717,2019

LT-S9279 IDIC



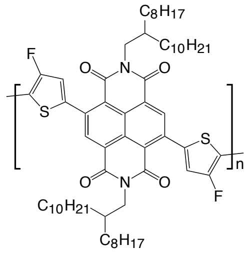
HOMO：-5.69 eV
LUMO：-3.91 eV
PCE：8.71%(with PDBT-T1)
J. Am. Chem. Soc,138, 2973,2016

LT-S9466 FBR



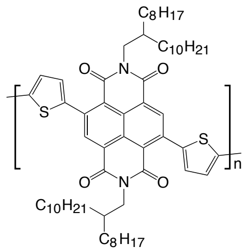
HOMO：-5.70 eV
LUMO：-3.57 eV
PCE：4.11%(with P3HT)
J. Am. Chem. Soc,137, 898,2015

LT-S9449 F-N2200



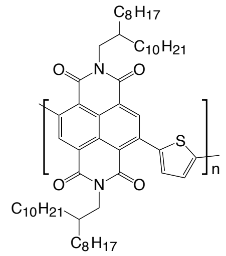
HOMO：-5.99 eV
LUMO：-3.90 eV
PCE：14.5%
Nano,11,7215,2017

LT-S9282 P(NDIO2OD-T2)



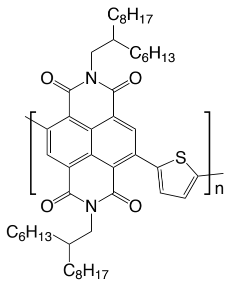
HOMO：-5.77 eV
LUMO：-3.84 eV
PCE：8.27%(with J52)
Adv. Mater,28, 1884,2016

LT-S9455 PNDI(2OD)T



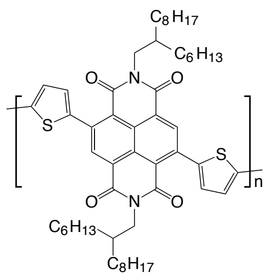
HOMO：-6.52 eV
LUMO：-4.04 eV
PCE：8.0%(with PBDTS-TPD)
Adv. Energy Mater,8, 1700908,2018

LT-S9454 PNDI(2HD)T



HOMO：-5.64 eV
LUMO：-3.94 eV
PCE：6.81%(with PTB7-Th)
J. Mater. Chem. A,5, 21291,2017

LT-S9448 PNDI(2HD)2T

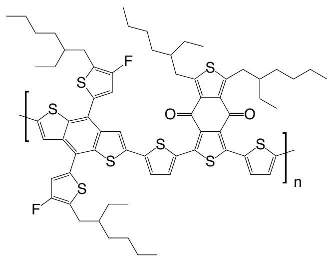


HOMO：-5.40eV
LUMO：-3.95 eV
PCE：6.42%(with P3)
Adv. Funct. Mater,27, 1701256,2017

Polymeric Donors / Small molecule Donor

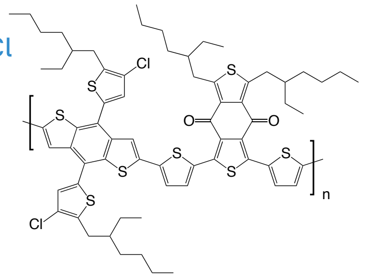
The following polymeric donors and small molecule donor are selected from open publications for your suggestions and validations only.

LT-S9457 PM6,PBDB-T-F



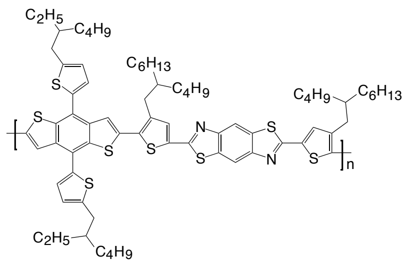
HOMO：-5.45 eV
LUMO：-3.65 eV
PCE：16.5%(with Y7)
Nat. Commun, 10,2515, 2019

LT-S9458 PM7,PBDB-T-Cl



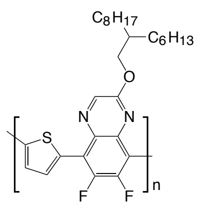
HOMO：-5.52 eV
LUMO：-3.57 eV
PCE：14.4%(with IT-4F)
Adv. Mater,30, 1800868,2018

LT-S9480 PBB-T



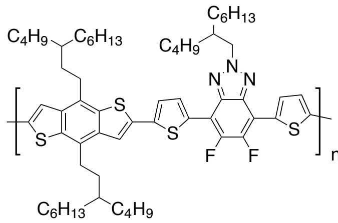
HOMO：-5.40 eV
LUMO：-3.30 eV
PCE：13.3%(with IT-2F)
Chem. Mater,31, 919,2019

LT-S9435 PTQ10



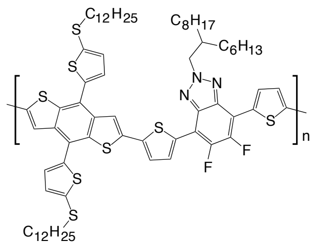
HOMO：-5.54 eV
LUMO：-2.98 eV
PCE：12.7%(with IDIC)
Nat. Commun, 9,743,2018

LT-S9497 FTAZ



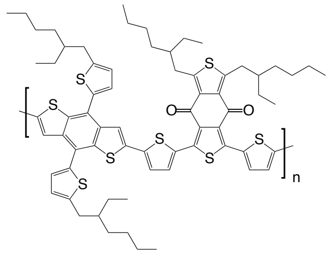
HOMO：-5.38 eV
LUMO：-3.17 eV
PCE：12.1%(with ITIC-Th1)
Adv. Mater,29, 1700144,2017

LT-S9463 J61



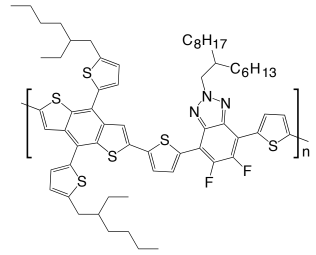
HOMO：-5.32 eV
LUMO：-3.08 eV
PCE：11.77%(with m-ITIC)
J. Am. Chem. Soc,138, 1501,2016

LT-S9273 PBDB-T



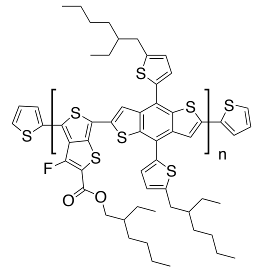
HOMO：-5.33 eV
LUMO：-2.92 eV
PCE：11.21%(with ITIC)
Adv. Mater,28, 4734,2016

LT-S9469 J52



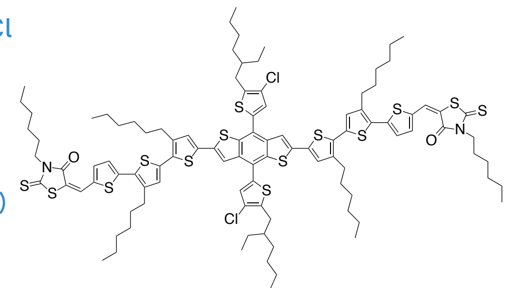
HOMO：-5.21 eV
LUMO：-2.99 eV
PCE：11.1%(with IT-N/IEICO)
Adv. Mater,29, 1700437,2017

LT-S9139 PTB7-Th



HOMO：-5.24 eV
LUMO：-3.66 eV
PCE：11.0%(with IDFBR)
Nature Materials,16, 363,2017

LT-S9498 BTR-Cl



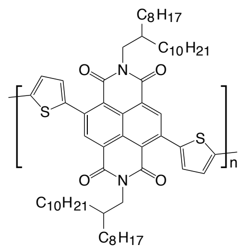
HOMO：-5.46 eV
LUMO：-3.70 eV
PCE：13.6%(with Y6)
Joule 3,3034,2019

Interface layer materials

In order to improve the collection efficiency of carrier, and reduce the potential barrier on the interface, a hole transport layer (HTL) and an electron transport layer (ETL) are generally introduced into the device architectures of organic solar cells. Usually, a HTL, between the active layer and anode, is a high-work-function material. It can effectively resist the injection of electrons, and also plays a role in transporting holes. The ETL between the active layer and cathode can effectively block the injection of holes and it also contributes to electron transport. Except for the inorganic materials, more and more organic materials have also been successfully applied as the ETLs in organic solar cells[4], the following interface layer materials are selected from open publications for your suggestions and validations only.

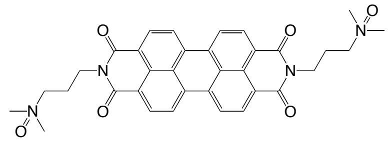
[4] *Renewable and Sustainable Energy Reviews, 52, 1527 (2015)*

LT-S9282 P(NDIO2OD-T2)



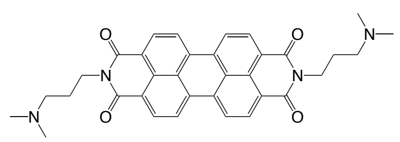
HOMO：-5.77 eV
LUMO：-3.84 eV
PCE：18.83%
J. Mater. Chem. A,5, 22824,2017

LT-S9479 PDINO



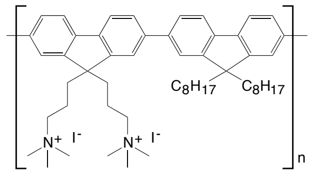
HOMO：-6.21 eV
LUMO：-3.63 eV
PCE：8.24%
Energy Environ. Sci,7, 1966,2014

LT-S9268 PDIN



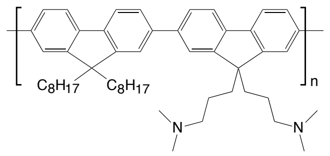
HOMO：-6.05 eV
LUMO：-3.72 eV
PCE：7.68%
Energy Environ. Sci,7, 1966,2014

LT-N8006 PFN-I



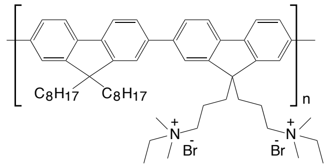
PCE：11%
Energ. Rev,52, 1527,2015

LT-N4027 PFN



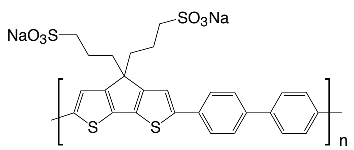
PCE：12.6%
J. Mater. Chem. A,3, 18432,2015

LT-N878 PFN-Br



PCE：17.36%
Science,361, 1094,2018

LT-S9499 PCP-Na



PCE：16.27%
Adv. Mater,30, 1803703,2018