EXHIBIT I

Infringement of U.S. Patent No. 10,224,359

ISOCELL Image Sensor S5K2LD
Samsung Galaxy Z Flip5

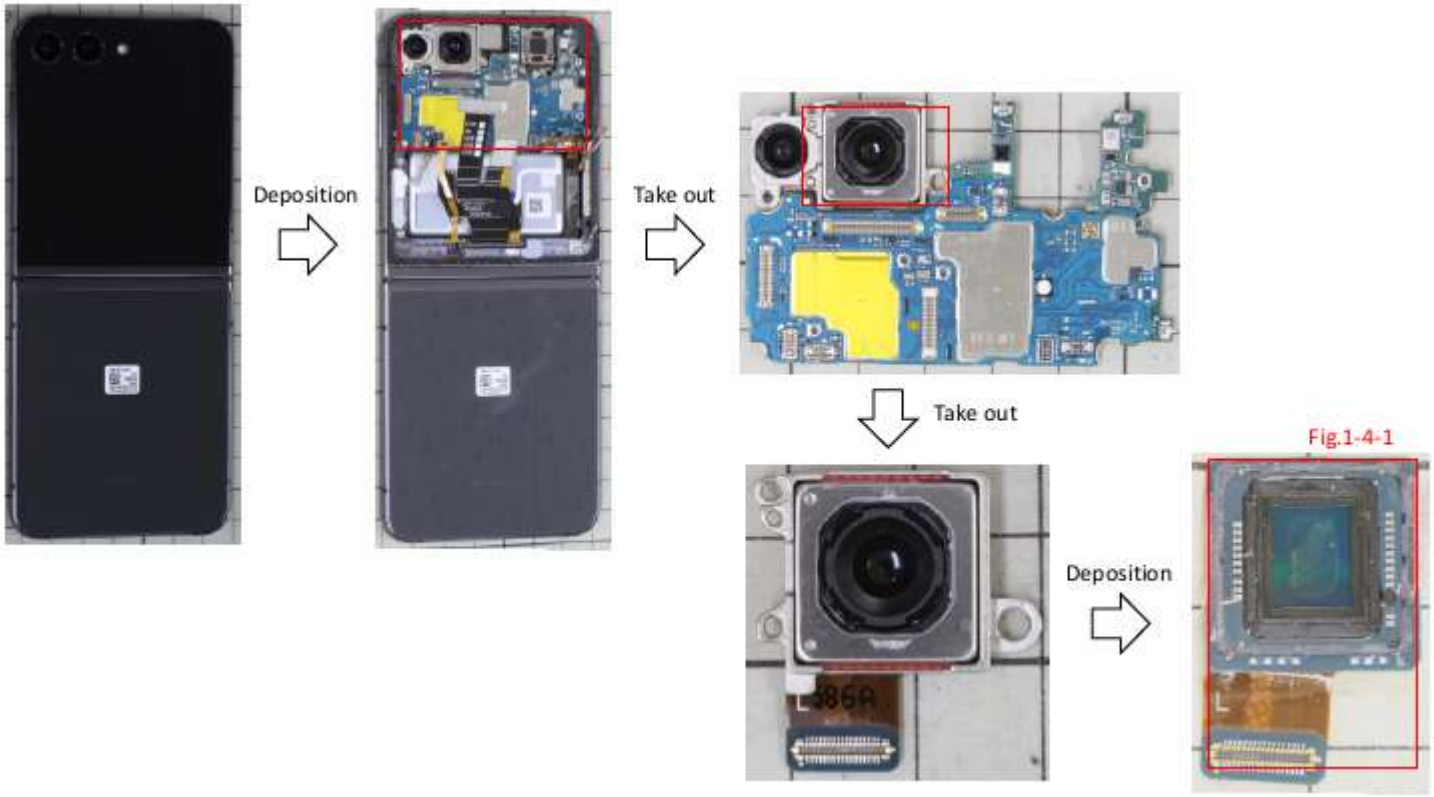
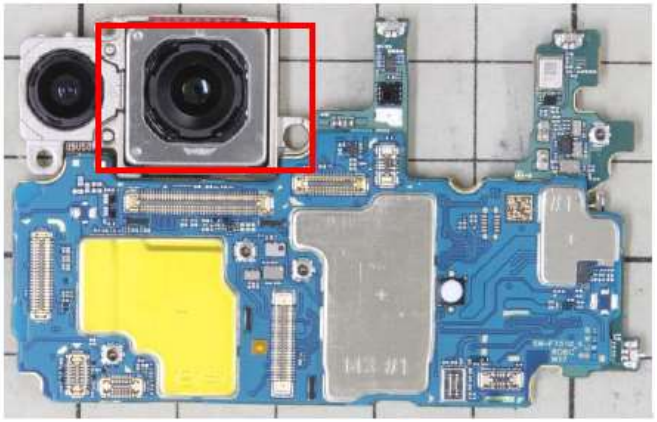
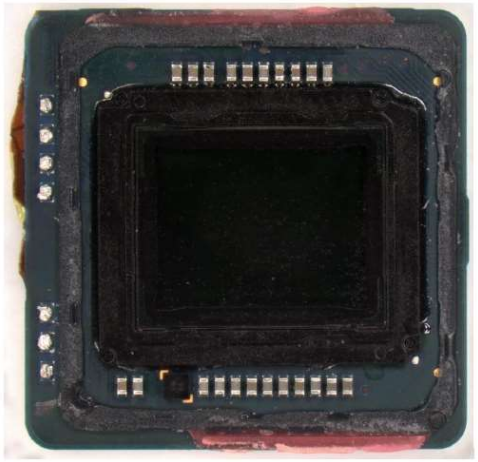


Fig. 1-3-1 Deposition process

U.S. Patent No. 10,224,359
Claim 1: An imager device, comprising:

Claim 1	
An imager device, comprising:	The Samsung Galaxy Z Flip5 comprises an imager device at least because it includes a Samsung ISOCELL sensor. The images below show the Samsung S5K2LD image sensor from the Samsung Galaxy Z Flip5.   Fig. 2-1-1 Image sensor appearance (Front)

U.S. Patent No. 10,224,359
Claim 1: An imager device, comprising:

Claim 1	

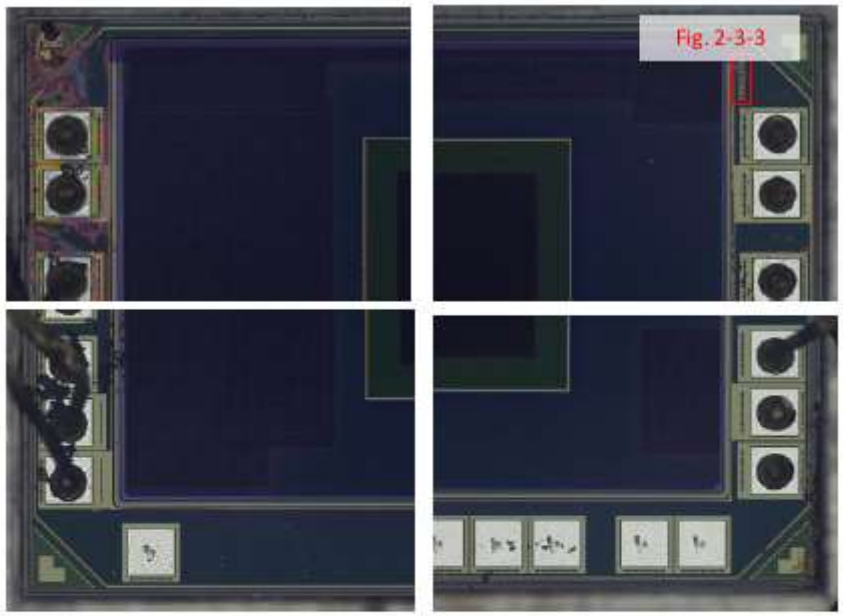
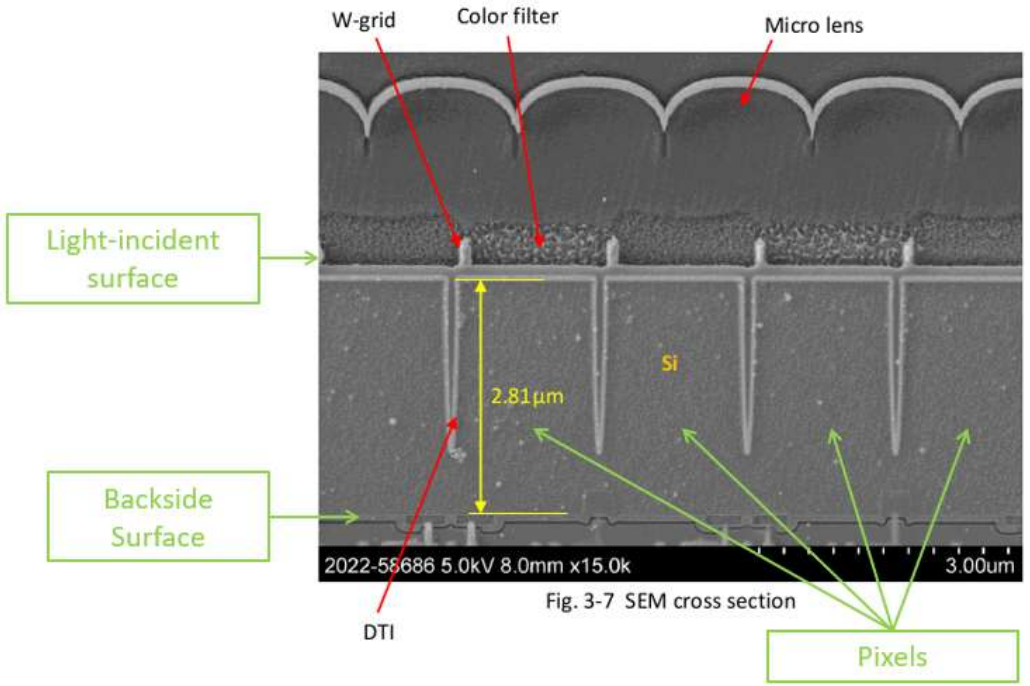
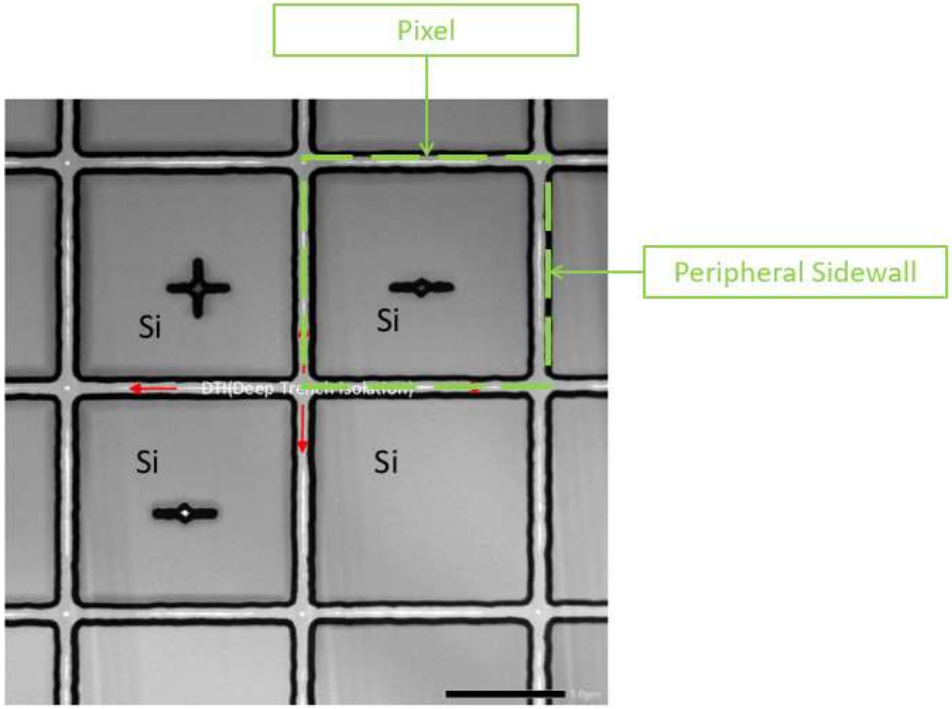


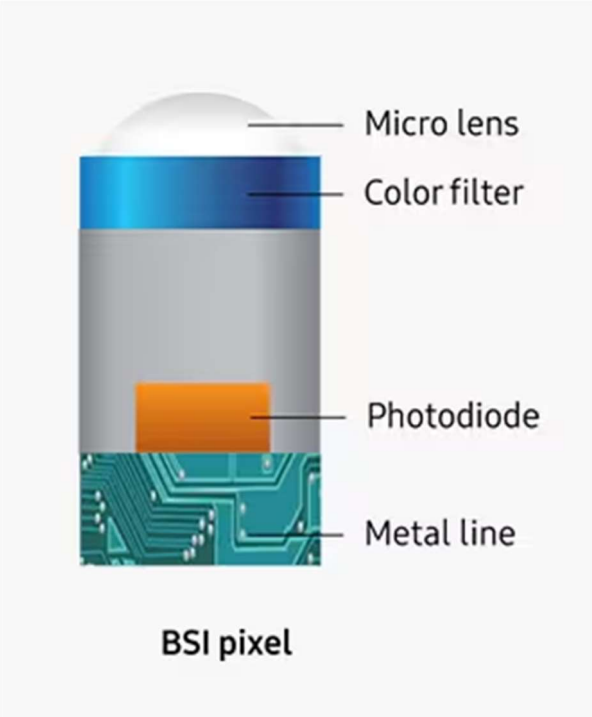
Fig. 2-3-2 Die corner

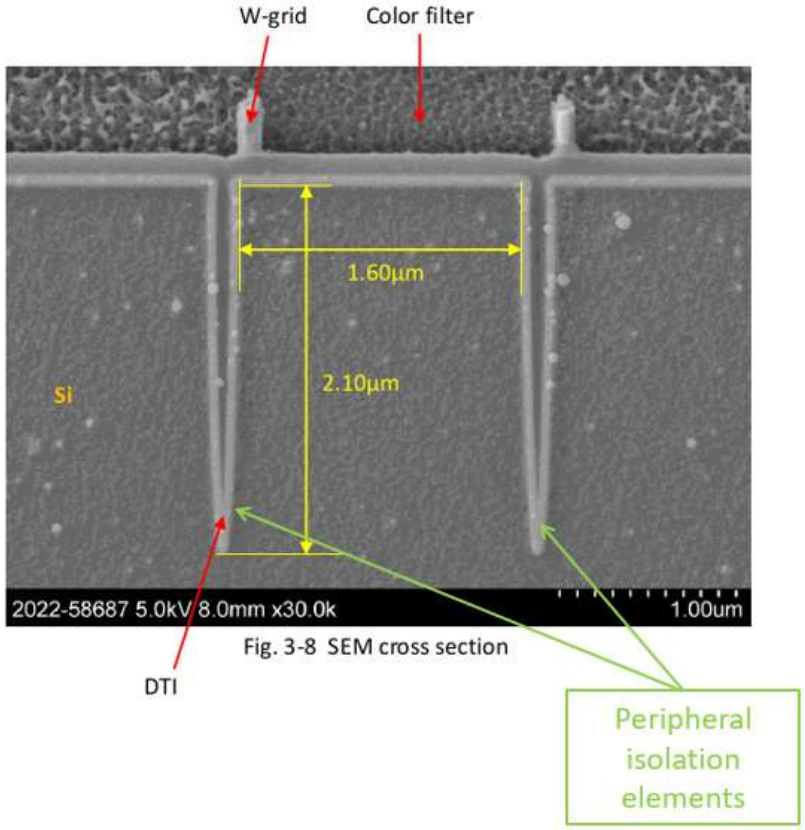
Fig. 2-3-3 Die marking (OM)

Claim 1(a): at least two adjacent light sensitive image sensor pixels each having a light incident surface, and a backside surface opposite the light incident surface;

Claim 1(a)	
at least two adjacent light sensitive image sensor pixels each having a light incident surface, and a backside surface opposite the light incident surface;	The ISOCELL sensor from the Samsung Galaxy Z Flip5 includes at least two adjacent light sensitive image sensor pixels each having a light incident surface, and a backside surface opposite the light incident surface. The cross section below shows adjacent light sensitive pixels of the ISOCELL sensor. Further, the images below show a light incident surface and a backside surface, opposite the light incident surface.  Fig. 3-7 SEM cross section

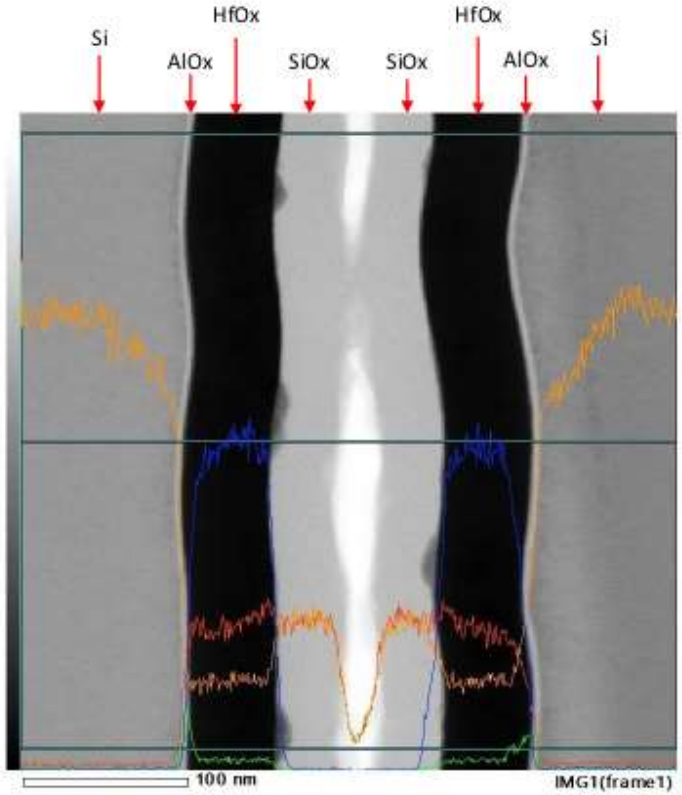
Claim 1(b)	
a peripheral isolation element at least partially separating said two adjacent light sensitive pixels;	The ISOCELL sensor from the Samsung Galaxy Z Flip5 includes a peripheral isolation element at least partially separating said two adjacent light sensitive pixels. The top-view of the ISOCELL sensor, below, shows that the peripheral sidewalls substantially surround the pixel periphery, separating adjacent pixels.  Fig. 4-2 BF STEM image

Claim 1(c)	
each of said pixels having at least one doped region disposed on at least one of the light incident surface and the backside surface,	The ISOCELL sensor from the Samsung Galaxy Z Flip5 includes at least two adjacent light sensitive pixels, each of said pixels having at least one doped region disposed on at least one of the light incident surface and the backside surface. As shown below, the ISOCELL sensor include BSI pixels with a doped region that makes a photodiode.  ISOCELL Plus: Leading the next generation of image sensors | Samsung Semiconductor Global

Claim 1(d)	
wherein the peripheral isolation element comprises at least two materials having different indices of refraction,	The ISOCELL sensor from the Samsung Galaxy Z Flip5 includes at least two adjacent light sensitive pixels, wherein the peripheral isolation element comprises at least two materials having different indices of refraction. The peripheral isolation elements are shown below:  Fig. 3-8 SEM cross section

Claim 1(d): wherein the peripheral isolation element comprises at least two materials having different indices of refraction,

Claim 1(d)	
	As shown in the energy dispersive X-ray spectroscopy below, the peripheral isolation elements comprise at least two materials. The materials in the Samsung ISOCELL sensor include silicon, silicon oxide, hafnium oxide, aluminum oxide, and a void, which have different indices of refraction.



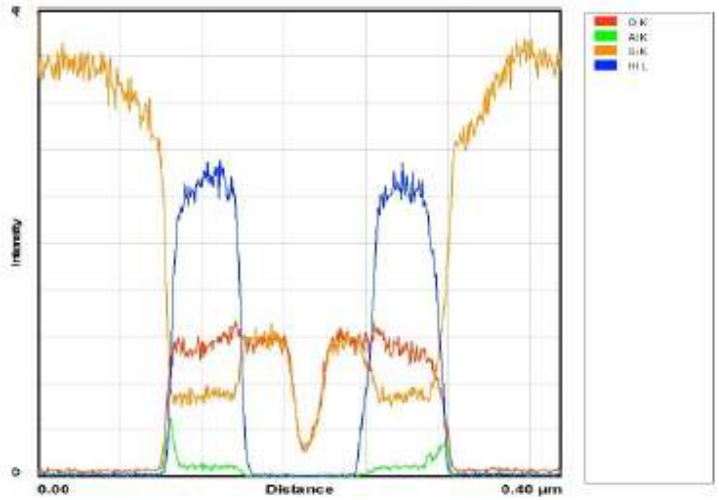
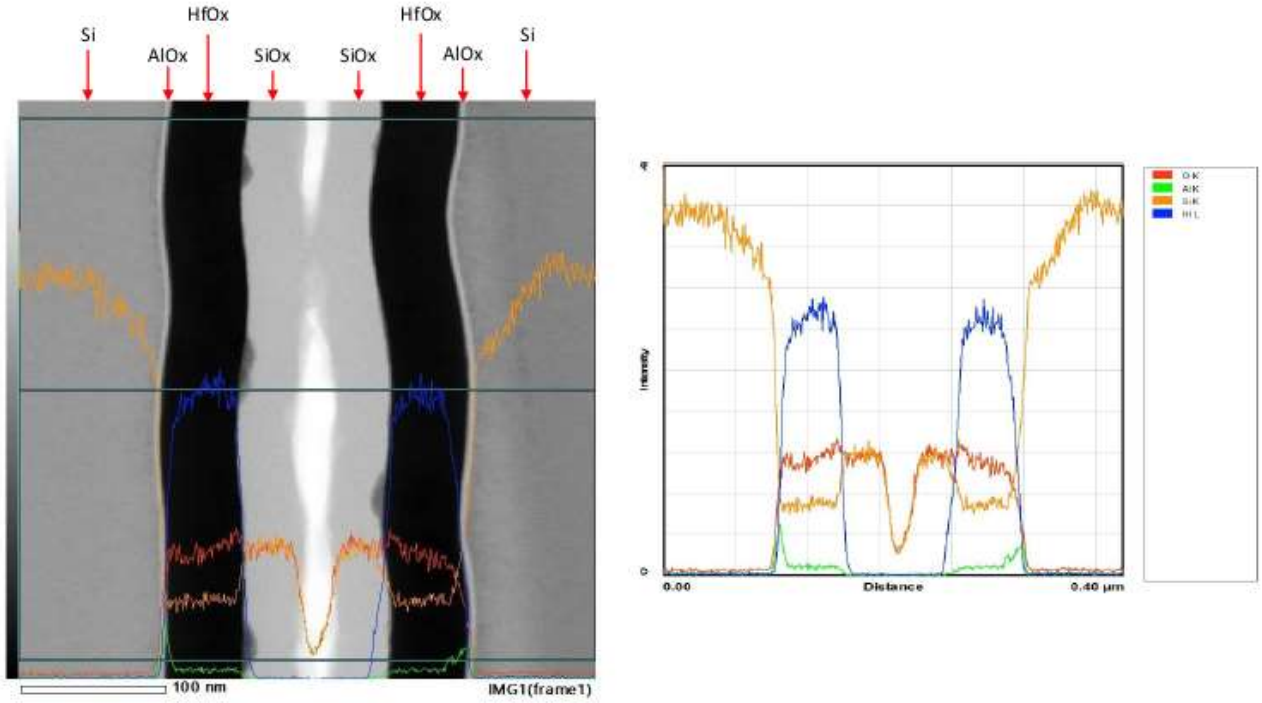
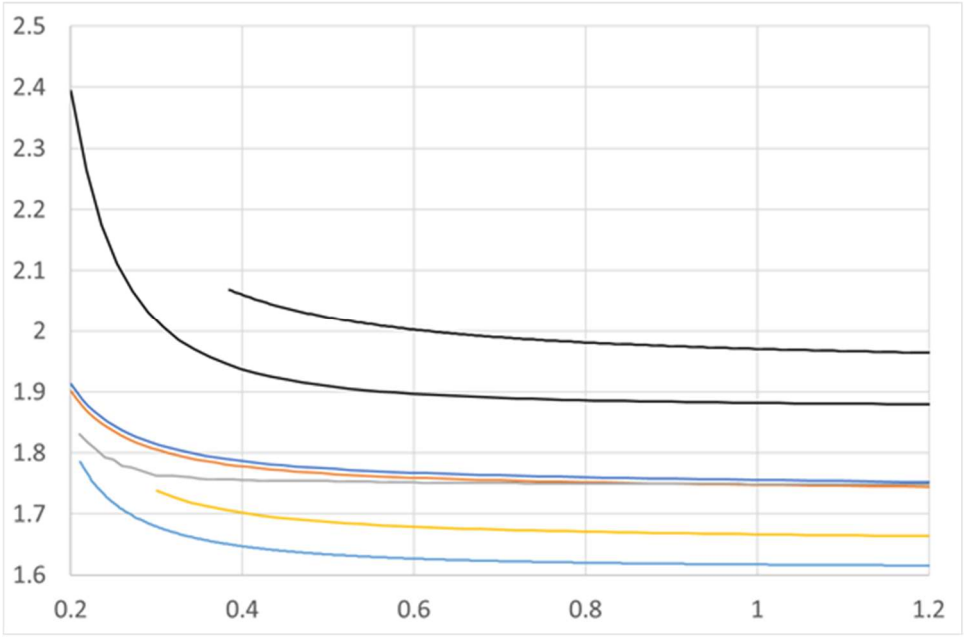


Fig. 6-1 Raw test data (number of atoms detected)

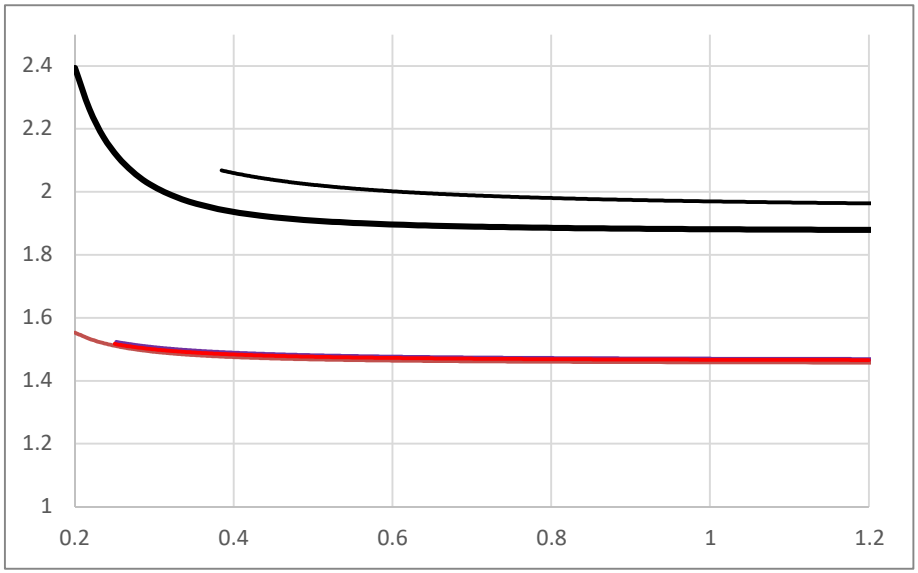
Claim 1(e): wherein said peripheral isolation element comprises a first, a second and a third layer, wherein said third layer is disposed between said first and second layers, and wherein each of said first and second layer exhibits an index of refraction less than an index of refraction of said third layer.

Claim 1(e)	
wherein said peripheral isolation element comprises a first, a second and a third layer, wherein said third layer is disposed between said first and second layers, and wherein each of said first and second layer exhibits an index of refraction less than an index of refraction of said third layer.	The ISOCELL sensor include a a peripheral isolation element wherein said peripheral isolation element comprises a first, a second and a third layer, wherein said third layer is disposed between said first and second layers, and wherein each of said first and second layer exhibits an index of refraction less than an index of refraction of said third layer. As shown below, the peripheral isolation element comprises of a first, a second and a third layer. Electron dispersive X-ray spectroscopy shows the silicon, silicon oxide, hafnium oxide, aluminum oxide, and a void layers. The first layer can be, for example, the SiOx layer, the second layer can be, for example, the AlOx layer, and the third layer can be, for example, the HfOx layer.  Fig. 6-1 Raw test data (number of atoms detected)

Claim 1(e): wherein said peripheral isolation element comprises a first, a second and a third layer, wherein said third layer is disposed between said first and second layers, and wherein each of said first and second layer exhibits an index of refraction less than an index of refraction of said third layer.

Claim 1(e)	
	The graph below shows the indices of refraction for hafnium oxide (black curves) and aluminum oxide (colored curves).  Refractive index of HfO2 (Hafnium dioxide, Hafnia) - Bright (HfO2, Bright); Refractive index of HfO2 (Hafnium dioxide, Hafnia) - Al-Kuhaili (HfO2, Al-Kuhaili); Refractive index of Al2O3 (Aluminium sesquioxide, Sapphire, Alumina) - Zhukovsky (Al2O3, thin film Zhukovsky); Refractive index of Al2O3 (Aluminium sesquioxide, Sapphire, Alumina) - Boidin (Al2O3, thin film Boidin); Refractive index of Al2O3 (Aluminium sesquioxide, Sapphire, Alumina) - Querry-o (Al2O3, Querry-ordinary); Refractive index of Al2O3 (Aluminium sesquioxide, Sapphire, Alumina) - Malitson-e (Al2O3, Malitson-extraordinary); Refractive index of Al2O3 (Aluminium sesquioxide, Sapphire, Alumina) - Malitson-o (Al2O3, Malitson-ordinary).

Claim 1(e): wherein said peripheral isolation element comprises a first, a second and a third layer, wherein said third layer is disposed between said first and second layers, and wherein each of said first and second layer exhibits an index of refraction less than an index of refraction of said third layer.

Claim 1(e)	
	The index of refraction for hafnium oxide (black curves) is likewise greater than the index of refraction for silicon dioxide (colored curves).  Compiled from RefractiveIndex.info (last visited March 5, 2024) (Hafnium Oxide: https://refractiveindex.info/?shelf=main&book=HfO2&page=Bright, https://refractiveindex.info/?shelf=main&book=HfO2&page=Al-Kuhaili; Silicon Dioxide: https://refractiveindex.info/?shelf=main&book=SiO2&page=Rodriguez-de_Marcos, https://refractiveindex.info/?shelf=main&book=SiO2&page=Gao, https://refractiveindex.info/?shelf=main&book=SiO2&page=Lemarchand) (last visited March 5, 2024)

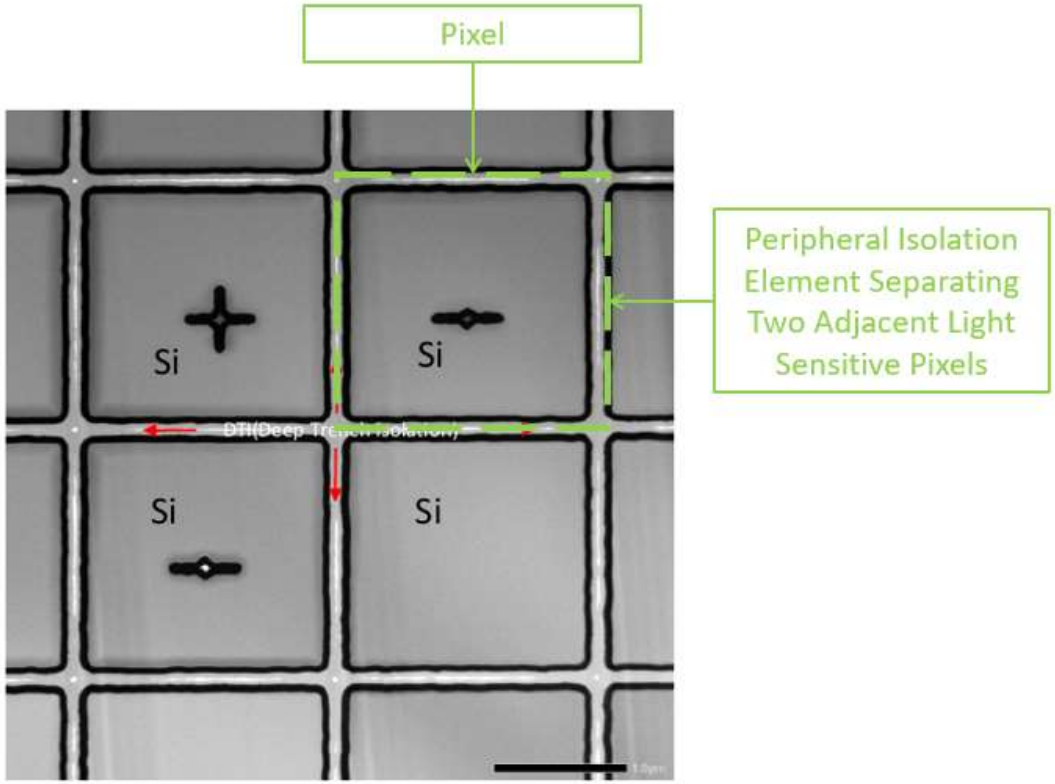
Claim 18: An imager device, comprising:

Claim 18	
An imager device, comprising:	The Samsung Galaxy Z Flip5 comprises an imager device at least because it includes a Samsung ISOCELL sensor. *See* Claim 1, *supra*.

Claim 18(a): at least two adjacent light sensitive image sensor pixels each having a light incident surface, and a backside surface opposite the light incident surface;

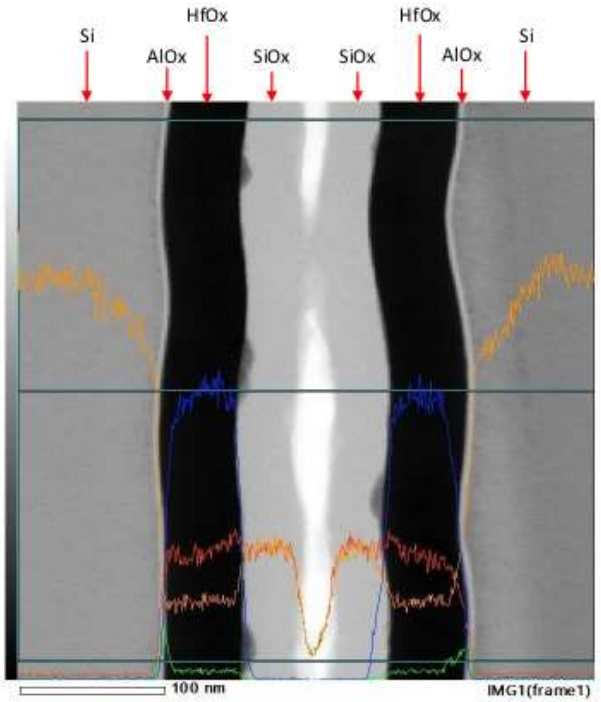
Claim 18(a)	
at least two adjacent light sensitive image sensor pixels each having a light incident surface, and a backside surface opposite the light incident surface;	The ISOCELL sensor from the Samsung Galaxy Z Flip5 includes at least two adjacent light sensitive image sensor pixels each having a light incident surface, and a backside surface opposite the light incident surface. *See* Claim 1(a), *supra*.

Claim 18(b): a peripheral isolation element separating said at least two adjacent light sensitive pixels so as to reduce optical crosstalk therebetween, said isolation element comprising at least two materials having different indices of refraction,

Claim 18(b)	
a peripheral isolation element separating said at least two adjacent light sensitive pixels so as to reduce optical crosstalk therebetween, said isolation element comprising at least two materials having different indices of refraction,	The ISOCELL sensor from the Samsung Galaxy Z Flip5 includes a peripheral isolation element separating said at least two adjacent light sensitive pixels so as to reduce optical crosstalk therebetween, said isolation element comprising at least two materials having different indices of refraction. The top-view of the ISOCELL sensor, below, shows that the peripheral sidewalls substantially surround the pixel periphery, separating adjacent pixels.  Fig. 4-2 BF STEM image

Claim 18(b): a peripheral isolation element separating said at least two adjacent light sensitive pixels so as to reduce optical crosstalk therebetween, said isolation element comprising at least two materials having different indices of refraction,

Claim 18(b)	
	The graph in the image below, the materials include silicon, silicon oxide, hafnium oxide, aluminum oxide, and a void.



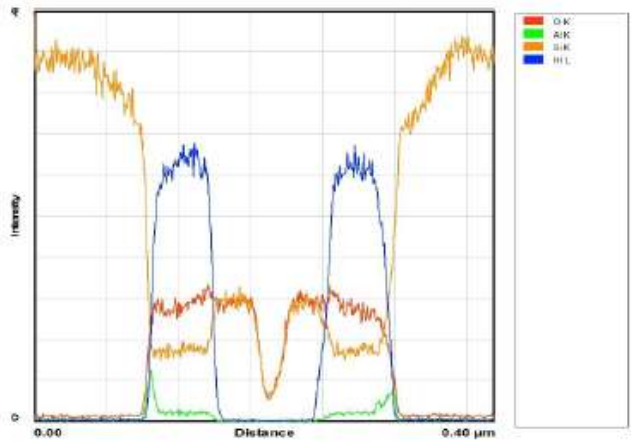


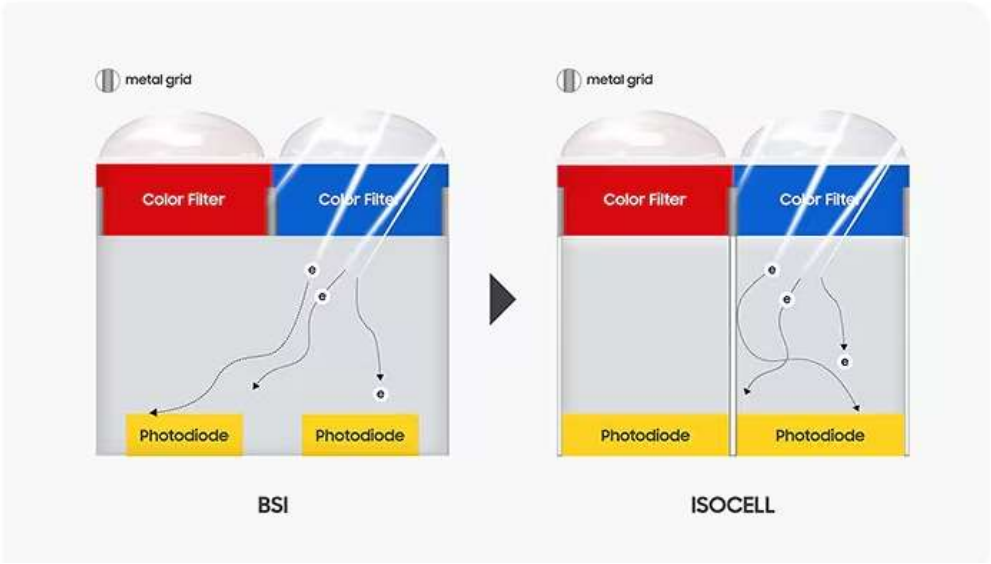
Fig. 6-1 Raw test data (number of atoms detected)

Claim 18(b): a peripheral isolation element separating said at least two adjacent light sensitive pixels so as to reduce optical crosstalk therebetween, said isolation element comprising at least two materials having different indices of refraction,

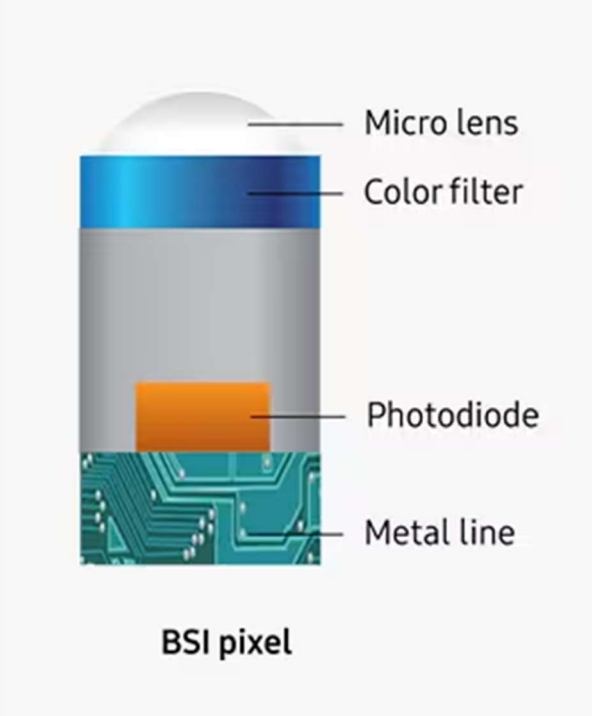
Claim 18(b)	
	As explained by Samsung, the peripheral isolation elements in its ISOCELL sensor are intended to reduce crosstalk.

The ISOCELL Revolution

With backside illumination already addressing many of the light absorption issues, Samsung's ISOCELL technology addressed the problems created by crosstalk. Engineers designed a physical barrier between neighboring pixels, isolating them and allowing more light to be gathered by the micro-lens and absorbed by the photodiode.



ISOCELL Plus: leading the next generation of image sensors, Samsung Tech Blog, July 1, 2019, available at https://semiconductor.samsung.com/news-events/tech-blog/isocell-plus-leading-the-next-generation-of-image-sensors/ (last visited March 26, 2024)

Claim 18(c)	
at least one doped region disposed on at least one of the light incident surface and the backside surface,	The ISOCELL sensor from the Samsung Galaxy Z Flip5 includes at least one doped region disposed on at least one of the light incident surface and the backside surface. As discussed in claim 1(c), and as shown below, the ISOCELL sensor includes BSI pixels with a doped region that makes a photodiode.  ISOCELL Plus: Leading the next generation of image sensors | Samsung Semiconductor Global

Claim 18(d) wherein said peripheral isolation element comprises a first, a second and a third layer, wherein said third layer is disposed between said first and second layers, and wherein each of said first and second layers exhibits an index of refraction less than an index of refraction of said third layer.

Claim 18(d)	
wherein said peripheral isolation element comprises a first, a second and a third layer, wherein said third layer is disposed between said first and second layers, and wherein each of said first and second layers exhibits an index of refraction less than an index of refraction of said third layer.	The ISOCELL sensor from the Samsung Galaxy Z Flip5 includes a peripheral isolation element wherein said peripheral isolation element comprises a first, a second and a third layer, wherein said third layer is disposed between said first and second layers, and wherein each of said first and second layers exhibits an index of refraction less than an index of refraction of said third layer. *See* Claim 1(e), *supra*.