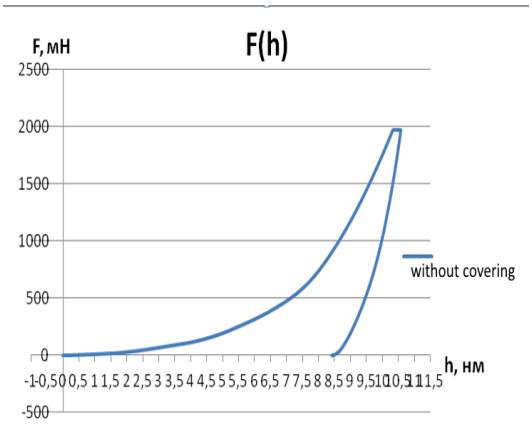

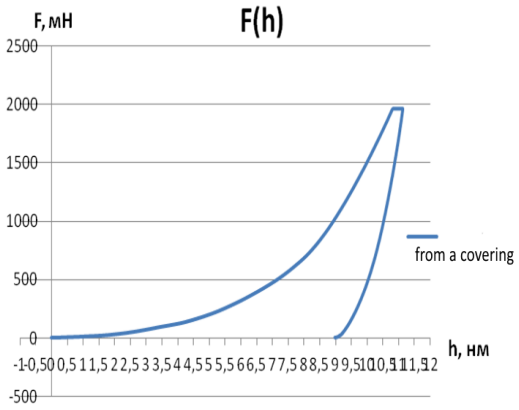

Cave-in was calculated as a difference of thickness of polylactic acid without active layer and with it. Film thickness without d1=3,0997 active agent, with d2=3,6205 active agent (micron). d=d2-d1 d=3,6205-3,0997 = 0,5208 (microns) thickness of an active layer. Our research has proved that this is the best method for measuring the thickness of new hybrid biodegradable materialmodified layer.

REFERENCES

1. Vroman I., Tighzert L. Biodegradable Polymers // Materials (Basel). 2009. V. 2. № 2. P. 307–344.
2. Athanasiou K.A., Niederauer G.G., Agrawal C.M. Sterilization, toxicity, biocompatibility and clinical applications of polylactic acid/polyglycolic acid copolymers. // Biomaterials. 1996. V. 17. № 2. P. 93–102.
3. Rasal R.M., Janorkar A. V., Hirt D.E. Polylactic acid modifications // Prog. Polym. Sci. 2010. V. 35. № 3. P. 338–356.
4. Suganuma J., Alexander H. Biological response of intramedullary bone to poly-L-lactic acid // J. Appl. Biomater. 1993. V. 4. № 1. P. 13–27.
5. Wynn T.A., Chawla A., Pollard J.W. Macrophage biology in development, homeostasis and disease. // Nature. 2013. V. 496. № 7446. P. 445–455.

ULTRA HD (4K) MONITORS

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Introduction

4K technology seems to be on the cusp of taking over the HD digital media world, from TV screens to computer monitors to cameras and projectors, 4K screen resolution and all of its accompanying features are starting to circulate widely [1].

4K resolution

4K resolution, also called 4K, refers to a display device or content having horizontal resolution on the order of 4,000 pixels. Several 4K resolutions exist in the fields of digital television and digital cinematography. In the movie projection industry, Digital Cinema Initiatives (DCI) is the dominant 4K standard [2].

A 4K resolution, as defined by Digital Cinema Initiatives, is 4096 x 2160 pixels (256:135, approximately a 1.9:1 aspect ratio). This standard is widely respected by the film industry along with all other DCI standards [3].

DCI 4K should not be confused with ultra-high-definition television (UHDTV) AKA "UHD-1", which has a resolution of 3840 x 2160 (16:9, or approximately a 1.78:1 aspect ratio). Many manufacturers may advertise their products as UHD 4K, or simply 4K, when the term 4K is traditionally reserved for the cinematic, DCI resolution. This often causes great confusion among consumers [4].

The use of width to characterize the overall resolution marks a switch from the previous generation, high definition television, which categorized media according to the vertical dimension instead, such as 720p or 1080p. Under the previous convention, a 4K UHDTV would be equivalent to 2160p [5].

YouTube and the television industry have adopted Ultra HD 1 [UHD-1] as its 4K standard and "UHD-2" for NHK/BBC R&D's 7680x4320 pixels UHDTV 2 with their basic parameter set is defined by the ITU BT.2020 standard. As of 2014, 4K content from major television networks remains limited. On April 11, 2013, Bulb TV created by Canadian serial entrepreneur Evan Kosiner became the first broadcaster to provide a 4K linear channel and VOD content to cable and satellite companies in North America. The channel is licensed by the Canadian Radio-Television and Telecommunications Commission to provide educational content. However, 4K content is becoming more widely available online including on YouTube, Netflix and Amazon. As of 2015, some UHDTV models were available to general consumers in the range of US$400[6].

UHD is a resolution of 3840 pixels × 2160 lines (8.3 megapixels, aspect ratio 16:9) and is one of the two resolutions of ultra-high definition television targeted towards consumer television, the other being FUHD which is 7680 pixels × 4320 lines (33.2 megapixels). UHD has twice the horizontal and vertical resolution of the 1080p HDTV format, with four times as many pixels overall [7].

Televisions capable of displaying 4K resolutions are seen by consumer electronics companies as the next triggerfor an upgrade cycle due to a lack of consumer interest in 3D television [8].

Ultra-high-definition television

Ultra-high-definition television (also known as Super Hi-Vision, Ultra HD television, UltraHD, UHDTV, or UHD) includes 4K UHD (2160p) and 8K UHD (4320p), which are two digital video formats proposed by NHK Science & Technology Research Laboratories and defined and approved by the International Telecommunication Union (ITU) [9].

The Consumer Electronics Association announced on October 17, 2012, that "Ultra High Definition", or "Ultra HD", would be used for displays that have an aspect

ratio of at least 16:9 and at least one digital input capable of carrying and presenting native video at a minimum resolution of 3840×2160 pixels [10].

Ultra-high-definition television is also known as Ultra HD, UHD, and UHDTV. In Japan, 8K UHDTV will be known as Super Hi-Vision since Hi-Vision was the term used in Japan for HDTV. In the consumer electronics market companies had previously only used the term 4K at the 2012 International CES but that had changed to Ultra HD during the 2013 International CES. The Ultra HD term is an umbrella term that was selected by the Consumer Electronics Association after extensive consumer research [11].

Moving 4K into Home Theater

While the origins of 4K film go back quite a ways and have their roots in theatrical releases of films such as Blade Runner: The Final Cut back in 2007, it wasn't until James Cameron filmed his now famous "Avatar" in 4K resolution that the projection platform itself was widely introduced in many theaters eager to please audiences with beautiful crystal screen clarity [12].

However, going from theaters to something like home entertainment is a big leap and it wasn't until just within the last couple of years that both projectors and the already mentioned TVs became widely available for home theater system set up that would let consumers enjoy UHD clarity in their houses [13].

Now, in terms of TV 4K systems, this resolution isn't even entirely noticeable unless you enjoy a very large and thus very expensive screen or are sitting abnormally close to your TV. However, when it comes to projectors, the power offered by 4K really does become visible [14].

Most 4K projectors offer at least 4,096 x 2,160 pixels of resolution and because they typically offer projection area sizes that totally dwarf all but the largest 4K TVs, this is where you really notice the difference between UHD and regular HD content [15].

With a projector showing native 4K content or even upscaled 1080p HD content, you finally get to experience picture clarity in your own home that imitates on a smaller scale what you'd find with a large UHD public theater screen [16].

History

The first commercially available 4K camera for cinematographic purposes was the Dalsa Origin, released in 2003. YouTube began supporting 4K for video uploads in 2010. Users could view 4K video by selecting "Original" from the quality settings until December 2013, when the 2160p option appeared in the quality menu. In November 2013, YouTube started to use the VP9 video compression standard, saying that it was more suitable for 4K than High Efficiency Video Coding (HEVC); VP9 is being developed by Google, which owns YouTube [17].

The projection of films at 4K resolution at cinemas began in 2011.[23] Sony was offering 4K projectors as early as 2004. The first 4K home theater projector was released by Sony in 2012 [18].

In February 2014, HIGH TV (High 4K) launched the first Ultra HD, 24/7 General Entertainment TV Channel available worldwide. The channel was the first of its kind and featured a unique mix of Entertainment, Lifestyle, Extreme Sport, Movies

and everything in Ultra HD Quality, with 200 hours of New Content each year. The High 4K Team already distributes the channel to Pay TV Operators, IPTV, Mobile, Web TV, etc, as well as distributing 4K content worldwide [19].

Sony is one of the leading studios promoting UHDTV content, as of 2013 offering a little over 70 movie and television titles via digital download to a specialized player that stores and decodes the video. The large files (~40GB), distributed through consumer broadband connections, raise concerns about data caps [20].

In 2014, Netflix began streaming House of Cards, Breaking Bad and "some nature documentaries" at 4K to compatible televisions with an HEVC decoder. Most 4K televisions sold in 2013 did not natively support HEVC, with most major manufacturers announcing support in 2014. Amazon Studios began shooting their full-length original series and new pilots with 4K resolution in 2014 [21].

In early 2014, adult sites started offering 4K video content [22].

The Benefits of UHD 4K TV

4K TVs don't just come with the benefit of enormously enhanced resolution. They include a number of other features that distinguish them from more conventional TVs [23].

First of all, let it be clear that even if the difference in resolution isn't too noticeable on a typical 4K screen size from a normal viewing distance, it is definitely there. The extra and much smaller pixels make a real difference whether your eye sight lets you notice them or not and additional features like ultra-high refresh rates and specialized technologies like MotionFlow (found in Samsung brand 4K TVs) will dramatically improve your viewing experience [24].

Furthermore, buying a 4K TV gives you access to future connectivity specs and future visual specs that will come in handy as broadcasters catch up to the new technology [25].

Also, the illumination capacities of most UHD TV brands use highly advanced technologies such as LCD panels illuminated by LED backlights in the form of local dimming or full array dimming systems that dramatically improve picturebrightnessand contrasts [26].

If what you're looking for is maximal image quality features –even if you don't particularly care about 4K UHD resolution itself—the major 4K lines of TVs from major manufacturers also happen to offer the top of the line in terms of these other image enhancement capabilities and they offer them at prices that are steadily dropping towards very affordable ranges [27].

Finally, understand that 4K content is growing into the market as you read this. 4K film camera prices are dropping too and a lot of new content is being filmed and distributed based on this platform. Furthermore, the Blu-ray Disc Association is well along with plans to have its 4K version of Blue-ray ready for public release by the end of this year [28].

And as we've already covered above with streaming content, compression and transmission codecs such as HVEC are going to make sure that both 4K broadcasts

and 4K home theater systems are mutually compatible for delivering UHD content even if bandwidth conditions for most homes don't improve significantly [29].

Tiled displays and panel types

As with other PC monitors, the current crop of 4K monitors employ an array of different panel types: TN (Twisted Nematic), IPS (In-Plane Switching), and IGZO (Indium Gallium Zinc Oxide), with TN panels usually priced the lowest, followed by IPS panels, then IGZO[30].

TN panels are typically targeted at gamers or mainstream users and offer the fastest response times. Compromises in color accuracy or viewing angles, however, mean they're ill-suited for pro users [31].

IPS panels have very good viewing angles and color reproduction, but response times are somewhat slower than in TN panels. For comparison, Acer recently released separate 2560x1440 FreeSync and G-Sync monitors. The TN-based FreeSync display offered 1-millisecond response times, versus the IPS-based G-Sync display's 4ms [32].

IGZO panels feature a different transistor type in the panel's TFT backplane (versus more commonly used amorphous Silicon, or aSI) that offers better power characteristics and less mass, which is ideal for use in high-density displays like a 4K monitor [33].

Choosing the ideal panel type for your setup will depend on your particular needs, but given the choice between slightly faster response times versus better viewing angles and color accuracy, we'd usually take the latter—budget permitting, of course [34].

Refresh rates with 4K panels are also somewhat of a concern. A number of the more affordable 4K displays currently on the market offer only 30Hz refresh rates. The typical refresh rate of a mainstream display is 60Hz, and fast gaming-monitors can offer as high as 144Hz. Although some would argue that 30Hz is fast enough for video and image editing, the user experience with a 30Hz display can be nauseating. Mouse and window movements are jerky, and the smoothness we've all become accustomed to using 60Hz (or faster) displays goes right out the window. Stick to a 60Hzor higher display if at all possible [35].

Early 4K displays used multi-stream transport technology, which Windows registers as two separate 1920x2160 panels side-by-side [36].

Another oddity with many 4K PC monitors is that they're recognized as dual displays, each with resolutions of 1920x2160. Many of the most recently released 4K displays feature newer internal scalers than can handle true 4K resolutions. Older tiled displays required dual scalers and need to be connected to a system via two HDMI or DisplayPort cables, or by using a single DisplayPort cable paired with graphics card that could support a feature called MST, or multi-stream transport—all this to achieve a 4K resolution with a 60Hz refresh rate [37].

While MST was a clever way to get around an early hurdle with 4K displays, the technology can act pretty wonky when you're using software designed to appear only on one screen in a multi-monitor environment—the menus in PC games are one glaring example. Look for a monitor supporting single-stream transport and true 4K resolutions instead [38].

Windows scaling

Another major consideration with 4K displays is desktop or DPI scaling within Windows [39].

The pixel density of virtually all of the 4K PC displays currently available is so high—because the pixels are so small—that icons and text can look incredibly tiny when 100% scaling is used. Raising the DPI scaling in Windows can increase the size of application windows and menus to make them more easily readable/usable. Not all applications scale properly when the DPI scaling level is increased: Some applications will look blurry, while others remain tiny, or don't render all interface elements properly [40].

Microsoft has focused considerable effort to fix scaling issues with Windows, and has also pushed software developers to fix their applications, but issues persist to this day[41]

Before getting a 4K display, do your homework. Check whether any of your most commonly used applications have problems on high-dpi displays. PCWorld's guide to making the Windows desktop look good on high-resolution displays can help you squash those pesky scaling issues if you decide to take the 4K plunge [42].

Color

Get richer and more vivid colors that were meant to be seen in 4K. Many monitors only offer you 16.7 million colors, but a UHD monitor gives you 64 times more – for an incredible 1 billion colors. That means everything you see is accurate, detailed, natural-looking and so vivid that it will take your breath away. There's also a smoother transition between different tones, passing through more shades in between [43].

Conclusion

4K computer monitors are like many other things in computing. Most people don't need the more expensive option, but it's a definite upgrade if you have some extra money to spend. They'll also continue to trickle down, becoming cheaper and cheaper until 4K becomes the new baseline for basic computer monitors [44].

REFERENCES

[1][7][8][12][13][14][15][16][23][24][25][26][27][28][29] http://4k.com/resolution/
[2][3][4][5][6][17][18][19][20][21][22]http://en.wikipedia.org/wiki/4K_resolution
[9][10][11] http://en.wikipedia.org/wiki/Ultra-high-definition_television
[30][31][32][33][34][35][36][37][38] http://www.pcworld.com/article/2906385/4k-monitors-everything-you-need-to-know-about-ultrahd-pc-displays.html
[39][40][41][42] http://hardware_software.complexdoc.ru/2425081.html
[43]http://www.samsung.com/levant/consumer/computers-peripherals/monitors/led-monitor/LU28D590DS/ZN
[44] http://www.howtogeek.com/206710/should-you-buy-a-4k-computer-monitor/