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Active and intelligent fibre-based packaging – innovation and market introduction

LIST OF DEFINITIONS

Term	Definition
2D codes	A 2D (two-dimensional) barcode is a graphical image that stores information horizontally and vertically, enabling fast data access.
3D printing	A process of making three dimensional solid objects from a digital file. It is achieved using additive processes, where an object is created by laying down successive layers of material.
3D scanning	A process which enables measurement and recording of shapes and colors of existing physical objects to generate a computer-compatible digital file.
Absorbed light transformed to heat switches color changes	Heat energy is constantly converted to light energy. Things change color—and why their color changes (from red to white) as they get hotter and spew out different kinds of light energy.
Active barrier	Active (or dynamic) barriers work by impeding the action to be carried out.
Active packaging	Intended to extend the shelf-life or to maintain or improve the condition of packaged food. It is designed to deliberately incorporate components that would release or absorb substances into or from the packaged food or the environment surrounding the food.
Analogue signal processing	Any signal processing conducted on analog signals by analog means. “Analog” indicates something that is mathematically represented as a set of continuous values.
App toys	A toy industry term for products that incorporate a smart device application into a play experience with a toy. Examples range from smart devices inside plush toys to apps facilitating play.
Augmented reading	Starts with words but extends beyond a text-only experience, through the help of additional information and content sources embedded in the book, which make it more immersive.
Augmented reality	Augmented reality refers to the overlaying of virtual objects on top of users’ view of their environment in an interactive, multi dimensional and real-time way.
Biomaterials	Biomaterials encompass a whole range of materials which can be biobased, biodegradable, or both. Biobased means that the material or product is (partly or wholly) derived from biomass (plants). Biomass stems from e.g. corn, sugarcane, or cellulose – forest and agriculture products. The term biodegradable depicts a chemical process during which micro-organisms that are available in the environment convert materials into natural substances such as water, carbon dioxide and. The process of biodegradation depends on the surrounding environmental conditions (e.g. humidity or temperature, exposed or buried), on the material. Fibre-based materials meet both properties.
Biophotonics	Denotes a combination of biology and photonics, with photonics being the science and technology of generation, manipulation, and detection of photons, quantum units of light.(light).
Bioplastics	Bioplastics encompass a whole range of materials which can be biobased, biodegradable, or both. Biobased means that the material or product is (partly or wholly) derived from biomass (plants). Biomass used for bioplastics stems from e.g. corn, sugarcane, or cellulose – forest and agriculture products. The term biodegradable depicts a chemical process during which micro-organisms that are available in the environment convert

	materials into natural substances such as water, carbon dioxide and. The process of biodegradation depends on the surrounding environmental conditions (e.g. humidity or temperature, exposed or buried), on the material.
Biosensors	Consists of a bioreceptor specific to a target analyte (enzymes, antigens, microbes, nucleic acids, hormones) and a signal transducer element (optical, colorimetric, electrochemical) which is connected to the data acquisition and processing systems.
Cellulose-based bioproducts	Materials derived from renewable biological resources. After the cellulose is isolated from wood, the cellulose-based products can be developed.
Cellulose-based packaging materials	Packaging materials made of cellulose materials either in fiber form (cellulose pulp) or folis, molds (CNF, NCC).
Co-creation	Co-creation refers to the cultural practice of audience participation and cooperation in the creation of a cultural product. An example of co-creation are player modifications for a digital game.
Colour evaluation	Colour evaluation represents one of the most important object attribute being of primary concern when the consumer make a choice and fundamental in assessing object properties.
Chromogenic inks	Functional printing inks, where the color changes as a result of an external stimulus such as heat (thermochromic), light/radiation (photochromic), certain substances (hydrochromic, solvatochromic) and electrical current (electrochromism).
Cross Media	The term "Cross-Media" is often explained as something that includes the distribution of content (e.g. music, text, pictures, video etc.) amongst different media.
Crowdsourcing	('crowd' + 'outsourcing') refers to the process of obtaining services, ideas or content by seeking small contributions from a large group of people, typically from an online community.
Data carriers	2D barcodes and radiofrequency identification tags (RFID), which are intended for storage, distribution, and traceability purposes.
DIY culture	Do-it-yourself culture, or DIY, refers to the larger movement of creating goods and services yourself, as opposed to simply buying them readymade.
Double Screening	Double screening is consuming content on a first screen while doing something else on a second device, such as searching for additional information or commenting what they see on the first screen.
Electronic paper	A portable, reusable storage and display medium that looks like paper but can be repeatedly written on (refreshed) - by electronic means - thousands or millions of times.
Fibre-based packaging materials	Packaging materials made mostly of fibrous materials either biobased (cellulose) or synthetic (PE, PP....).
Fibre-based plastic packaging	Packaging manufactured from or containing fibre-based materials - either biobased or synthetic fibers. Often composites with biobased or synthetic polymers?. They are most commonly combined, and/or become so called bioplastics.
Food loss	Food loss refers to a decrease in quantity or quality of food. Food loss in the production and distribution segments of the food supply chain is mainly caused by the functioning of the food production and supply system or its institutional and legal framework.
Food packaging	Primary packaging developed and manufactured to come into contact with food. A package provides protection, tampering resistance, and special physical, chemical, or biological needs. It may bear a nutrition facts label and other information about food being offered for sale.
Food quality	Food quality is the quality characteristics of food that is acceptable to consumers. This includes external factors as appearance (size, shape, colour, gloss, and consistency), texture, and flavour; factors such as federal grade standards (e.g. of eggs) and internal (chemical, physical, microbial).
Food safety	Food safety is a scientific discipline describing handling, preparation, and storage of food in ways that prevent foodborne illness. This includes a number of routines that should be followed to avoid potentially severe health hazards.

Food spoilage	Spoilage is the process in which food deteriorates to the point in which it is not edible to humans or its quality of edibility becomes reduced. Various external forces are responsible for the spoilage of food. Food that is capable of spoiling is referred to as perishable food.
Food waste	An important part of food loss is called food waste, which refers to the removal of food from the food supply chain which is fit for consumption, or which has spoiled or expired, mainly caused by economic behaviour, poor stock management or neglect.
Fossil-based packaging	Packaging manufactured from oil-based plastics. Plastic is a polymer-based material that is characterized by its plasticity. The main component of plastics (from Greek: plastikos - fit for moulding, plastos - moulded) is a polymer, which is formulated by the addition of additives and fillers to yield the technological material – plastic. The majority of plastics in current use are manufactured from fossil fuels – a non-renewable finite resource.
Freshness indicators	Monitor the quality of packed food by reacting to the changes taking place in food as a result of chemical changes, microbial growth or metabolism due to the exposure to detrimental conditions or exceeded shelf life.
Functional barrier material	The functional barrier is able to prevent any migration of specific (?) contaminants or other substances from environment / surroundings to food or vice versa.
Functional Inks	Functional inks are inks consisting of an electrically functional element. The three classes of functional inks necessary toward printed electronics are semiconducting, conducting and dielectrics.
Functional packaging	Packaging materials which are able to monitor or improve the shelf-life and quality of packaged product.
Gas indicators	Provide qualitative or semi-quantitative information about the presence or absence of particular gas or altered gas concentration (oxygen, carbon dioxide, ethanol) in packaging through a visual colorimetric change.
Gas sensors	Gas sensors are devices that respond reversibly and quantitatively to the presence of a gaseous analyte by changing the physical parameters of the sensor and are monitored by an external device.
HDR imaging	A set of techniques used in imaging and photography, which allows a greater dynamic range of luminance between the darkest and the lightest areas of an image by merging several different exposures of the same scene.
Hybrid printing systems	Technologies that combine different printing techniques in one production line for achieving a graphic product with added value.
Hyperspectral imaging	The technique to capture, through special detectors, and analyse complete images. The goal is to find objects, identify materials and thus to detect processes.
ICT	Information and communications technology (ICT) is often used as an extended synonym for information technology (IT).
Image analysis	Image analysis is the extraction of meaningful information from images. Image analysis can include such tasks as finding shapes, detecting edges, segmentation etc.
Indicator	Intelligent system which indicates the presence or absence of a targeted substance in packaged food.
Infotracing	The integration of innovative systems such as RFID tracing with geostatistics for optimizing supply chain and logistics decisions may offer great competitive opportunities for the entire supply chain.
Innovative printing	It combines legacy of advanced multifunction product leadership with proven solid ink technology, which has a track record of reliability.
Intelligent packaging	Monitors the condition of packaged food or the environment surrounding the food. Intelligent packaging, with its ability to detect, sense and record the changes in the products environment, is an extension of the communication function of traditional packaging.

Interactive packaging	Packaging, by definition, is interactive; Packaging is designed to yield interaction between the consumer and the product itself. Ideally, the interaction results in a conversion, i.e. the consumer buys the product. Interactive packaging in this case refers to technical innovations that allow the user of a particular product to engage with the product in a new way.
Migration	The transfer of chemical contaminants from food contact materials into food The transfer of chemical contaminants from food contact materials into food.
Multilayer packaging material	A single packing structure built of several material layers that will combine the different properties of different base materials in order to meet these design requirements.
Multimodal interaction	A system providing the user multiple modes of interaction supports multimodal interaction. This applies to both input and output and users use the systems e.g. by a combination of speech and touch.
Neural networks	An artificial network are non linear multivariate modeling systems consisting of a pool of simple processing units which communicate by sending signals to each other over a large number of weighted connections.
NFC	Near Field Communication is a short-range wireless connectivity technology that uses radio frequency range to enable communication between electronic devices in close proximity.
Organic Semiconductor	Is an organic material with semiconductor properties, that is, with an electrical conductivity between that of insulators and that of metals. Single molecules, oligomers, and organic polymers can be semiconductive. They open possibilities to thinner and cheaper devices, such as transistor, light-emitting diodes and solar cells.
Overall migration limit	The sum of all substances that can migrate from the food contact material to the food (or food simulant). The overall migration limit is a measure for the inertness of the material.
Packaging Value Chain	A value chain is a chain of activities that companies operating in a specific industry performs in order to deliver a product or service for the market. The packaging value chain encompasses the whole life cycle of packaging, including many companies from the producers of feedstock materials, packaging materials manufacturers, package fillers to distributors. It also takes into account the users of the packaging – usually the consumers, and all the infrastructure and industries that deal with packaging when it becomes a waste – the waste management industry.
Printed battery	Flat, cheap and low energy batteries are being printed. They can come handy in large volume and temporary usage applications as packaging; powering simple sensors and marketing gadgets or cosmetics.
Printed electronics	Printed electronics is a set of printing methods used to create electrical devices on various substrates. Printing typically uses common printing equipment suitable for defining patterns on material.
Printed sensors in paper	Computer-created environment that responds to human interaction and that can simulate physical presence, actions, sensory experiences such as sound, touch, strength, smell, etc.
RFID	Known as Radio Frequency Identification. This wireless technology use radio-frequency electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to or embedded onto objects.
Sensor	Intelligent system which detects, locates, quantifies and transmits information about analytes in packaged food.
Shelf life	Shelf life is the length of time that a commodity may be stored without becoming unfit for use, consumption, or sale.
Skylanders	A fusion of a game console adventure game and an action figure toy line. Skylanders toys connect to a game console and instantly activates a matching virtual character in the game.
Smart packaging	This is an overarching term to address both active and intelligent packaging at the same time
Smart Posters	Smart Posters are posters which combine the visual impact of a traditional poster with the interactivity offered by NFC technology.

Specific migration	Limits the possible toxicology of a chemical substance migrating from food packaging to food. Substances which are restricted by a specific migration limit are for instance plasticizers, stabilizers or anti-static agents.
Spectroscopy	The use of the absorption, emission or scattering of electromagnetic radiation by atoms, molecules, atomic or molecular ions and solids as related to the dependence of wavelength of the radiation.
Substrates for printed electronics	The decision between types of substrates, whether it is paper, plastic film, metal or other, is critical in the design of printed electronics systems. Each of these substrates has its advantages and disadvantages.
Sustainability	Sustainability is most commonly described by the definition that arose at the Rio conference on climate change: The use of resources without jeopardizing the ability of future generation to do so as well - in other words ensuring that today's growth does not jeopardize the growth possibilities of future generations. Sustainable development comprises of three elements - economic, social and environmental - which have to be considered in equal measure at the political level. The strategy for sustainable development, adopted in 2001 and amended in 2005, is complemented inter alia by the principle of integrating environmental concerns with European policies which impact on the environment.
Sustainable packaging	Sustainable Packaging is designed to be effective and safe throughout its life cycle. Sustainable Packaging: Is beneficial, safe & healthy for individuals and communities throughout its life cycle; Meets market criteria for both performance and cost; Is sourced, manufactured, transported, and recycled using renewable energy; Optimizes the use of renewable or recycled source materials; Is manufactured using clean production technologies and best practices; Is made from materials healthy throughout the life cycle; Is physically designed to optimize materials and energy; Is effectively recovered and utilized in biological and/or industrial closed loop cycles.
Telepresence	Refers to the sense of being in an environment, other than the actual, physical location, by means of a medium. The environment can be real or computer-generated.
Time & temperature indicator	A device or smart label that shows the accumulated time-temperature history of a product.
User created content	Refers to a wide variety of content created by the users of services or software that specifically solicit this kind of user participation.
Virtual reality	Computer-created environment that responds to human interaction and that can simulate physical presence, actions, sensory experiences such as sound, touch, strength, smell, etc.